Anatomical Lectures

Delivered By

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Volume I.

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Anatomy

Lect 1st When You consider Gentlemen, the office of a Physician, or the Scope of medicine which undertakes to preserve Health, and to cure Disease. ie To prevent or to Rest Disorder in the Human frame, It must surely appear to You that the foundation of this science consists in the just knowledge of the situation, structure, connection & properties of the severed organs, and of the powers by which its functions are performed in health, and this knowledge being acquired by us[illegible] asunder the parts of the body by Dissecting it, the art conveying it is called Anatomy, & should imply not merely that the Dissection is conducted in a skillfull manner, but that Just[illegible] even experiments, & aid which Art furnishes is called in to disclose both the

the structure and Oeconomy of the body.

The Physician applys his Anatomical knowledge in two ways, viz. Either by a proper direction of the Key of the Machine, He enables it to Resist such impressions as might prove hurtfull, To rectify or to moderate the irregularity of its functions, however produced, as to Subdue or expell such matter as when Received Disturbs its functions, Clogs as it were the Wheels of Life, or in a more simple & mechanical manner By the Assistance of the hand and instruments He endeavours to palliate or To cure diseases. For the first of these ways He is said to performe the office of the Physician, in the other He exercises the Imployments of the Surgeon, and the Dependence of both provinces on Anatomy will very evidently appear

appear to You on the slightest Reflection.

For unless the Physician knows exactly the situation & Connection of the several organs, their particular use & importance to the general welfare, Unless He knows the rise, Course, and Termination of the Circulating & Absorbing vessels, and how far their Disorders may affect the body Considered as a mere Hydraulic engine and unless He knows the Nerves, the particular degrees of sensibility, the Sympathy of one part with another, & of each with the whole, the power of motion, the manner & cause of this in each organ, & the importance of each to the genl welfare, it will be quite impossible for Him to understand the seat of inward disorders, to foresee the Symptoms & probable event, or to

lay

lay down Rational indications for removing it, or even to adapt the general effect of a remedy to the nature of the part diseased.

The dependence of the Surgical part upon Anatomy is still more evident, & with this further circumstance, that the mistake of the Surgeon may be more immediately dangerous or fatal. For unless he is intimately acquainted with the several circumstances just now mentioned, & more especially with the situation & connexion of parts, it will be difficult for him to determine how far an operation may be advisable i.e. whether the Patient will run more risk from the Disease committed to Nature than he would do from the operation. May suppose an operation is determined will properly to be done,

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I would allege that the success of the
Operator will be in general proportioned
to his skill in Anatomy seeing that
the common share of dexterity of hand
which most Surgeons possess is sufficient
for most Operations, & an Operation
being nothing but a Dissection performed
on a living Person, this must necessarily
be the case. So an Anatomist who
has never seen a particular Operation
done can venture to undertake it
with greater safety than a Surgeon
who is deficient in Anatomy tho' he
has the Operation many times. For
the Anatomist proceeds on certain
principles, sees the reason of every
step and knows where to place
the greatest caution, and if any
thing unforeseen presents he knows
how

how to remedy it. The other only in a manner immitates certain movements of the Hand, or instruments, without seeing the reason of them, & if He misses one step, or anything unusual occurs, He must be quite at a stand. He is rash perhaps where the utmost caution is required, & Timorous & Timorous where there is no real Danger.

Besides You are to consider, that without Anatomy the Manual part of Medicine can make little further progress towards perfection, than Accidental Operations, or the slow progress of Observation contributed to it, so in succesive ages the improvements of Anatomy & Surgery have kept an uniform pace.

It is not sufficient however for the practice

practice of Medicine that We understand
the structure of the body in a sound state.
We ought likewise to be informed of the
changes produced by Disease. For altho'
from knowing the various functions & organs
performing in Health, we are enabled to
draw just observations wch regard to the
Nature of diseases, yet trusting to that
alone We may often run into mistake.
So without paying any attention to the
effects wch change of place, alteration in
size & consistence &c produce. We shall
afterwards find that our several organs
are supplied from & in a great measure
composed of branches of the same
Hydraulic Machine. So that a Disease
primarily affecting a single organ, may
in various degrees be communicated

to

to others, or to the whole. Nor tho' we should be able to prosecute the Nerves & parts belonging to the Nervous System, yet we shall be far from being able to ascertain the Medium by which they operate & by means of which the Com=
=munication is maintain'd between the living & corporeal parts. Add to this That the living principle influ=
=enced thro' a single organ may reach over all, in a way we cannot from our ignorance of their Nature reduce to Rule. Hence we see plainly the impossibility of determining the Nature of diseases from Reasoning a priori, and That We must begin from the top of the Chain by wh the Great Author of Nature unites

causes

Causes and effects, and must have re=
= course to Observation by dissection, otherwise
by mistaking the Cause We must be
misled in the Cure. Thus if We put
the most favorable supposition, That
by giving a certain Remedy You remove
a complaint or Symptom, Yet if You
are ignorant of the Cause of it, Your
Observation does not admit of general or
future application, because the Cure
must be varied according to the
number of Causes that can produce
the same general appearance. So an
Anatomist finds That Dropsy depends
upon a variety of causes, many of which
demand a quite opposite method of
Cure. Nay where We put the most
unfavorable supposition, that We
Knows

know from dissection that certain Symptoms & Complaints proceed from incurable Disorders of the Viscera, yet here our knowledge is not only Creditable to ourselves & agreeable to the Relations, but it is of Real use to the Patient, as instead of exhausting his strength wt attempting a Radical cure, we merely endeavour to Palliate the Symptoms & support Nature. Nay dissection is of use altho' we understand that the first Cause eludes the observation of our imperfect senses, as where the Nervous influence is affected or a Taint communicated to the Mass of blood, because the effects of this become Causes of further disorders which are discoverable by the Dissection, so we may

Conclude

Conclude in the words of the Elegant
Celsus "Neque enim, cum Dolor intus
" incidit aere, quid Dolcat, cum qui, qua
" parte, quodque visceris intestinumve sit
" non cognoverit credendum est et cum
" Recte Curaturum, quem primum ejus
" causa non fefellerit. Prudere igitur
" mortuorum Corpora descendibus necessarium,
" Nam positum et ordinem nosse debent"

To insist further on the importance
of Anatomy to the several branches of
Medicine would be improper, because
I am bound to suppose tho' I know
the contrary with respect to several
of You, that You are entirely ignt.
of the Study, & every step as We
proceed will furnish abundent
proof of it.

I shall therefore proceed

to

to Consider the most Just method of
acquiring Anatomical Knowledge,
For I have made it a rule of late years
to lay aside almost the form of Pre-
=liminary Lectures, and to Hasten to
those that are usefull & practical,
as I imagine that Your time cannot
only be more usefully employ'd but more
agreeably upon the Subject itself. —

It will at the first sight appear
evid^t, that an attempt to investigate
not only the fabric, but the functions
of animated bodies, must meet with
Considble difficulties, as our Frame
is not only of the most delicate &
at the same time of the most complic-
=ated Nature, but its different powers
wch Reguire when each other in a Circle,

do

so that we are at a loss to distin=
=guish between Cause and effect,
while life continues for a length of
time with almost unimpaired vigour,
and besides we find that the operations
of the body are greatly & wonderfully
influenced by the living principle
which as yet we do not understand.

This multiplicity of perplexing
circumstances connected together in
the same object has generally led
Physicians to divide the Study into
two distinct Branches, the one
comprehending the Anatomy, strictly
so called, the other the Physiology.
The first of these is solely employed
in describing the parts of the
Machine, whilst the other endeavours

to

to show in what manner, and from what causes it performs its functions.

Now admitting that these can with propriety be disjoind, it is evidt that the prosecution of either is attended wth much difficulty. For if I mean meerly to describe the parts, I cannot lay them before You, & attempt to join them so as to compleate the whole, Neither can We Analyze the body wth advantage till we are made acquaint with its Basis. If I make an opening in the Skin, I discover an organ called a Muscle and I may discribe the figure & situation of it, but without a knowledge of the Bones I cannot judge of its use, or force, so We must employ a more compound method here than in describing other pieces of

of machinery. Again when We proceed to the Physiology, it is so difficult to distinguish Cause from effect, That We are equally at a loss where to begin. If We consider the Heart as the Prime Mover, We soon observe that it's Nerves its energy continually from the Brain, and that again its influence from the Heart. What I have thus mentioned in a general way, may be sufficient to point out the Necessity of pursuing a proper method, and to draw your attention to the one I am to propose.

The Common method of explaining the Anatomy before we enter upon the functions of the organs is dry and disgusting, and we cannot attend to long descriptions without having in

view

view the application of them, besides
in the Physiological part, we are
surely best enabled to judge of the
parts whilst the Eye in view before
you, so it is material to adopt a
method, which while it leads to a
knowledge of the structure in a
Gradual way, without taking
any thing for granted that has
not been demonstrated, has at the
same time such an Eye to the
functions as that these may be
explained while we proceed, and
at the same time the application
to the practice pointed out. With
these views I shall observe the
following plan, for a more full
account of wh I refer you to

the

the sequel of the Course to be given.

After giving a general History of the Rise & progress of Anatomy & pointing out the chief sources of improvement and the method of perusing books, I shall lay before You the principle materials of wch our bodies are made up, endeavouring to explain ye use of each, & the manner of Connexion, so as to give a general idea of ye oeconomy. For without such an introduction, Beginners would not understand what is to be proposed of the use of the several parts, from the dependence of one part upon another, and upon the whole. We then proceed wth more accuracy to the particular Branches of Anatomy, and for the Reasons before hinted I begin with the

The basis of the body, By explaining the structure of the Bones, and the parts connected with them. These lead Naturally to the Muscles, or those organs which are connected to the Bones, & which possessing a contractile power enable us to perform our various motions, and & whilst We observe the effect of each Muscle, We will divide them into Classes and consider their operations as far as may seem Necessary. The knowledge of the Basis and of the Muscles furnishes a full & distinct out-line, by which we can discribe the Situation & Connexion of all the other material organs of the senses, of the glands, of the digestive bowels.

After We know the general use

of

of each Class, and the particular
character & office of each Organ in ye
Class, We are prepared to enter on
the System of the body in a more
general, extensive, & entertaining light,
as composed of parts connected and
communicating and all conspiring
to form one System or Whole, and
as in the Dissection We shall have
found, That the Nourishment We
take in, is conveyed to the Vessels
that contain the blood, it is evident
That the blood with the nourishment
must be in motion from one to
all other parts. We are led therefore
To trace this Motion, and to observe
the means by wch it is maintained
That by means of the Heart, Arteries
& Veins These are carried in a Circle.

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This enquiry opens further views, that there must be others than the circulating extremities of the vessels, for throwing off the useless parts, for lubricating all parts in our various motions & allowing an easy play: and we further see the necessity for a further Absorption to drain the cavities, to prevent their distension or the Subsaction of their fluids. and this last office is performed by vessels, which from their structure & contents are generally named by Anatomists, Valvular Lymphatics.

But the true nature & use of these being misunderstood by Systematic Writers, we shall find that the Doctrine concerning them has been generally placed in a less important

point

point of view than its merits. When
the Learner is so far acquainted
with Anatomy, reviews the actions of
the Muscles, the labours of ye heart
and of the Vessels in circulating y^e
humours, and the Impressions received
thro' the organs of our Senses, He
must suppose that to finish the
Description of an Animal, it remains
that We describe the organs by means
of which a communication can be
maintained between the Body and
Mind, by which the mind can
be made sensible of impressions
made on the body, or of injury
done to it, & our muscles enabled
to perform their motions. Accordingly
we shall find that there is a

power

powers dispersed from the Brain to the Nerves, on which both ye offices of sense and Motion depend. After considering the general properties of the Circulating, the absorbent, and Nervous Systems, we would proceed to trace the branches of each to their determinations, and consider ye effects which these have upon ye various organs. And when at length we have perceived the manner in wch the Arteries & Nerves enter an Organ, & the manner in which ye Veins and other Vessels come out of it, We are ready to disclose its intimate Structure, by the assistance of various preparations; Then, as far as can be done with Certainty

If

I shall endeavour to determine its office, for I will carefully distinguish between just Theory & false Hypothesis. We conclude then our various investi=gations of the different parts of the body, after having seen the course of these primary systems, on the modification of which the variety of structure in a great measure depends. In after explaining the structure of the organs in a sound state, by preparations, or parts of Morbid bodies preserved, I am to give an idea of the changes which the parts undergo by disease, so as to make a foundation for the practical Anatomy, or Anatomical Pathology, of the importance of which I

I already warned You.

Besides the operations in Surgery as well as Physiology which will be introduced into the Anatomical part of the Course, I shall treat as a distinct Branch the Surgery, or all the Diseases or accidents that admit of Palliation or Cure by Surgery, and after showing the changes made from Preparations, I shall lay down the Indications of cure, then I shall show all the Instruments, and perform all the operations before You on our Subject. With the after application of bandages and Machines used in Surgery.

The importance of this part will

will lead me to bestow particular
attention upon it, especially as I
mean to prove that from Anatom=
=ical considerations We may venture
on many occasions to Correct the
Practice of Surgery, as being quite
dependent on Anatomy. Having
finished the Human Anatomy and
all its dependencies, I shall in a few
Lectures illustrate the more obscure
functions by the Comparison of
the Anatomy of the Animals of
other Classes. And now having
exhausted every means of throwing
light upon the several functions, I will
Conclude all with a few Lectures on
such parts of the Physiology as the
Demonstrations did not lead us to
attempt.

Lect.

Lect. 2d.

In our last meeting Gentlemen, after endeavouring to point out to you the importance of Anatomy in Physic & Surgery, I laid before you the Plan we were to follow in the present course. Upon ye whole I propose, besides shewing ye structure, to explain the use, to give the Physiology of the several organs, as far as it admits of application to ye practice; to shew on many occasions the changes produced by disease, so as to lay some Foundation for the Anatomical Pathology, to treat as a distinct Branch, of Surgery, & to perform before you all the operations with the after treatment by means of bandages and Machines. & I

have

have Gave some Reason for My begining with the History of Anatomy, or with Many the rise & progress of the art.

Some years ago I used to treat of this part minutely, & endeavoured not only to point out the general scope of the several writers, but their chief discoveries. But of late years I have abridged this part greatly, in order to make room for the practical part of the Course. In prosecuting the History I shall follow nearly the order of time, For tho this in some Respects be less entertaining from the want of connexion, in that no art or Science has attained its perfection in the same order in wch it is taught. Yet this answers the purpose of History. For while we

satisfy

satisfy our Curiosity by admiring the steps by which the severall Discoveries were made & Carried forward & we do justice to the improvers of the art, and derive sources by which our knowledge may be improved by pointing out the way in which Practical writers in different ages have proceeded. —

As the Antiquity of a science, gives a presumption of its importance, so Writers generally trace that which they profess as far back as possible pointing out every circumstance wh might contribute to its origin or improvement. But as such enquiries are of but little use, & even but little entertaining, from the extreme uncertainty attending them, at a distance

of

of time in wch they are placed, I shall pass thro' the passages in a very cursory manner.

We are not however here, as in many parts of knowledge, allowed to indulge in conjecture, as we are tied down by the sacred Writings, which expressly tell us, that the sons of our first Parents offered up sacrifices, long before they were indulged in the use of Animal food, in wch as well as in Butchery, when flesh was permitted to Noah, an accurate division of parts was necessary. In sacrifice certain parts were laid aside as impure, & others reckond particularly proper for the service intended, while other parts again were allotted to the sacrifices, and in the Butchery

of

of the larger animals an exact division is necessary, and when the World came to be more peopled, Jealousy, Avarice, and Ambition soon embroil'd Mankind in War, & we read very early of Battles, in which ye interiors of the body would be more frequently laid in view than they are now, from their using chiefly sharp pointed and cutting instruments. When Men came to be better provided with ye Necessaries of life in Society, and to be protected by Laws, their security & leisure would lead them to attend to many things they had not before thought of & among other things we find, that they endeavoured to preserve the bodies of those who had made a figure in life, after death.

This

This practice was familiar to ye Egyptians
in the time of Joseph, and from the
term Mummy, this practice seems to
have taken its rise among ye Persians.
Mum in their language signifying Wax
wt. with the vessels were filled; and
this practice is of ancient date, as
Joseph lived 1800 years before Christ.
But no such very accurate knowledge
of Anatomy could be derived from this
practice as some fancy, for if you look
into Herodote, you will find that the
Operator was obliged to extract ye bowels
piece-meal, that the body might not
be maimed. But this joined to the
accidental inspection of wounds must
have confused Mankind in y Analogy
between the structure of their own
bodies, and that of Quadrupeds.

at

at length We find the Priesthood, ambit=
=ious of power, & ingenious in devising
the means of obtaining it, pretended
that future events were revealed to
them by certain signs & tokens, and
that those were more particularly
discernable in the Bowels of such
animals as were opened in sacrifice,
and the Credulity of Man keeping
pace with the progress of y^e imposture,
Nothing of importance was undertaken
without consulting the Augurs, or the
Auspices. This Art was begun
among the Eastern Nations, & took
place among the Romans soon af=
ter building of Rome; & from that it
is thought Anatomy must have
received great improvement, the

Knowledge

knowledge of the body in a sound state being necessary in order to point out every deviation from that state. But if you look into Livius, who relates all the Miracles by which Heaven was supposed to have disclosed itself to the Romans, you will find that in one case the Head was wanting, in another Two heads were found, so that the whole was a mere illusion or c. few of the bowels were only examined.

These are the chief means wh. for many ages must have impeded the knowledge of Anatomy; for neither in the Sacred Writings, nor in the Books of Homer, Herodote or Asculapius, Do we find that Anatomy was considered as a science of use or Entertainment,

Non

Nor are the sons of Asculapius much celebrated for their knowledge of Anatomy but merely from their skill in the virtues of simples.

At length the curiosity of the Philosophers of Greece paved the way for the farther improvement of Anatomy by admitting it into their studies as one of the branches of Natural Philosophy, and Thales, Empedocles, Democrates &c. all made considble improvements on it, and soon after we are indebted to Hippocrates for having detached Medicine as a distinct science or profession from the study of Philosophy; and on all occasions He considers Anatomy as the foundation of Medicine. With regard to the exact degree in which

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the skill of Hippocrates as an Anatomist is to be rank'd, I find very great differences among Writers. Some are blindly admiring antiquity pretend to find in Him almost all the Anatomical knowledge that is usefull, while others depreciate His skill on the opposite extreme. e Now as far as I can observe from a carefull perusal of His works in different places, We may venture to alledge, That in all He seems rather to understand ye value of the art, than to profess it; for His knowledge is amazingly superficial in many material points, and in some circumstances He is highly erroneous. For He confounds the arteries & veins not only under one genl. name of Phlebs, but He

He plainly understands them to be
Different Branches of the same Artery.
In like manner He confounds ye Tendons
with the Nerves, and His notions with
Regard to the latter are so extremely
imperfect That He ascribes ye office of
Sense & motion to the blood vessels.
I am far from finding with Dr Haller,
a clear evidence That Hippocrates ever
dissected the Human body. For the
proof of it mentioned by Haller as
Decisive, His discribing the Sub-clavian
Muscle, is by no means so, because
We find it in the Ape, which was y^e
common Anatomical Martyr of
that age & Country. The admirers of
Hippocrates, not contented with ascrib-
-ing an accurate knowledge of the
Structure of the Body to Him,

have

have pretended That He understood ye
nature of the blood, & even the con=
=sequence depending on that" the
Theory of Inflammation" But the
exact degree of this knowledge in these
respects will be best spoke of hereafter,
when We come to the full discovery
of the Circulation, when I shall lay
before You at one view all that was
known in former ages on that
very curious subject.

His Disciples made very considerable
progress in Anatomy, in works belonging
to them, tho' ascribed to Hippocrates.
It is evident that the Human body
was now dissected. The exact number
of the Vertebræ is mentioned, and of
the lobes which compose the Lungs
& there is an analogy drawn

which

which the Alimentary canal of a Man and of a Dog. Praxagoras of Cos first distinguished the arteries from the veins, and applyed the name of Artery to the bearing vessels, upon the supposition that they contain'd air or Spirit, and yet notwithstanding he thought to Judge of the state of the body & part of the blood by feeling the pulse. and in this Era I am mentioned by Galen a work composed by Diocles, on the manner of Dejection, from which We can have no clear proof of the frequency of such enquiries at the time.

We are now come down in the History, to the Era of Alexander the Great, or the 3d Century before Christ, where

We

We find great improvements made in Anatomy by Alexander Nemesis, or by His ingenious Preceptor Aristotle, whom We directed to compose a Natural history of Animals, and we are told by Pliny that He compleated this undertaking in 50 ~~years~~ Books or Volumes of which 11 are still extant. Unluckily those which more immediately treated of the Dissections of the Anatomy of Animals, have perished, but in those which remain, we find numerous works of considerable skill, and Aristotle attempted to illustrate his Discriptions by figures, an art wh. tho' extremely obvious, & of unspeakable use, was overlook'd by His Successors, & when it was revived near 2000 Years after

was

was consid^d as a new invention.

We are ignorant of the Studies of ye Eastern Nations, at or before this period almost all we know is, that the Greek Philosophers travelled into diff^t parts for their improvement, & that in Egypt the Physicians were confined to the cure of a single disorder by which it is supposed they acquired consid^ble knowledge.

But before the birth of Christ an Academy of arts & Sciences was instit= =uted at Alexandria by y^e Ptolomies, the successors of Alexander, which subsisted for 1000 years, and which was so highly cultivated that we are told by Celsus & Galen, that the Kings themselves were sometimes present at the Dissections, and in the works of Galen we have an

account

account of many of ye Alexandrian
Anatomists, two of which more immed=
=iately merit our attention, namely
Herophilus and Erasistratus, These
have treated accurately of ye human
structure, & have made Observations
wch have been ascribed to Later
Writers, Thus they both describe the
Vessels wch convey the nourishment
& wch are called Lacteals, They both
seperate the Stones from the Intestines
and by accurate & Decisive experiments
shew their true office, They have
also described the several parts of ye
Heart & given many names to
different parts of ye body wch are
retained at this day,

Medical knowledge seems to have
been at a very low ebb with the
Romans

Romans for many ages, for altho soon
after the days Romulus we find
mention made of Medici, yet in
reality their Physicians were Slaves,
or freedmen, who practised empirically
without any knowledge of Anatomy
or Surgery, & without any rational
principles, nor does it clearly appear
that any person being mancipated
under the Dominion of ye Romans
& in Italy practised Anatomy before
the Christian æra. For Tho Celsus
in his excellent book, De re medica,
considers Anatomy as ye foundation
of Physic, & before he treats of the
inward diseases, he premises one
Chapter, De Corporis humani Partibus
internoribus, and he discribes the
Positus

Positions & figura spicum totius Corporis Humani, & his Descriptions Tho' short, are in a great measure correct, But the greater part, Tho' by no means the whole, of this work is borrowed from the Greek Physicians; & near two Centuries have elapsed after the birth of Christ before we meet with original improvements. In the 2d Century Rufus & Soranus wrote some Treatises original Tracts.

Next we have a very elaborate work composed by Galen, wch contains not only the learning of ye foregoing ages, more especially that of the Alexandrian school, but it is enriched by a Description drawn from Dissections of the various organs of animals, compared on many

many occasions wth the Human body, not however always, & he has not only anticipated the Moderns in many discoveries, but in arts wch are supposed to be of a much later date. In some cases he enriches the subject by real experiments, he throws light on the functions of the Organs, particularly upon the motion of the blood, and import of ye Pulse; so that his works can still be read wth entertainment & if not with instruction, yet his opinions in general are more Hypothesis, but they were in gen^l so plainly connected into a System, that he was implicitly followed for 16 Centuries, tho they have been justly laid aside long ago, as being only the tallies

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of a luxuriant fancy.

In the 4th Century the Roman empire was overturn by Barbarous nations, and learning in a gen.l manner extinguish'd in the western parts; while in the East the Physicians contented to follow Galen, and had but little knowledge in Anatomy. We have in this period the works of Otius, Paulus, and Alexander.

In the 7th Century Alexandria was taken by the Arabians, the academy founded there, and which had subsisted near 1000 years, was entirely destroyed, and a celebrated library the repository of learning in the Eastern world almost quite consumed. When however the Saracens were quietly settled in their

their conquests, We find them sinking into the remains of the Greek and Roman Writers, by degrees translating them into their own language, & even adding some new diseases, as the Small Pox & Measles, with some new remedies, the produce of their own Country, But in Anat= =omy they made no improvement as by the tenets of their religion a person after touching a dead body was supposed to be unclean.

All Sunk in the X Century, for in all the sciences we meet with a Great Chasm here, from the superstition which overwhelm'd Europe during that period, When the Academies began to be Established, the Arabians carrying

over

over thin knowledge to the Western parts, and Montanus Gascoe (Wascon) is handed down as having first taught Anatomy in Europe. Academies & Universities were instituted in Italy & Montpelier in France, only they contented themselves wth reading the Works of the Arabians. and in the following Century we meet with a Decree of the Emperor Frederick 2^d ordering Anatomy to be taught, and preventing any person from practicing Physic who had not studied it. For several ages however the Professors confined themselves wth commenting on the Arabian writings, so that from the time of Galen, i.e. for near 1000 years, the Study of Anatomy so

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far from making improvements or progress, had been gradually losing ground. For the Writings of the Greeks & Romans had been in a great measure forgot, and the Original improvements neglected, while the Writings of ye Arabians, wh^ch were very imperfect were in their place substituted.

At length in the beginning of the 14th Century we find an original work composed by Mundinus, in the 1315. and tho' his Descriptions are, not only extremely superficial, but innaccurate, & his stile rude, yet his book was so highly esteem'd, that by an order of the Senate of Venice, the Professors of Padua were obliged to teach that only,

which

which gave occasion to abundance of Commentaries upon it.

Before the middle of the following Century i.e. in the 1440, The art of printing was discovered, and Nearly about the same time Constantinople, the Seat of the Eastern empire, was taken by the Emperor of the Turks; and in consequence of this, Learning was Revived & dispersed over Europe, by the Learned Men who fled from the Slavery of the Turks, & Carried the original writings of the Greeks & Romans along with them into the Western parts of it. So that Now ye number of Books comes to be great, and before the end of the Century we have some very Notorable compends of Analogy, particularly two, by Guido and Pendictus.

In the succeeding Century the 16th

Mel

We find the Spirit of improvements continued. Several new discoveries made by Nicolaus, Massa &c. But their merit is in a great measure eclipsed by the Writers who immediately succeeded them, Vesalius, Sylvius, Fallopius, & Eustachius, perhaps I may add Columbus, Who in a few years contributed more to the real knowledge of Anatomy, than had been done in all the former ages.

Vesalius is said to have shown a very early genius for Anatomy, and after the advantage of studying at different Universities, He was appointed Professor at Padua in the 23d year of his age. He first published his Epitome of Anatomy, & then his large work with figures, in which in a clear Nervous, Elegant style he describes the

the various organs of the body, teaches
his reader to follow them by dissections
and explains the descriptions of tables,
which are admired to this day by
Painters as well as Anatomists, and
every where he divests himself of a
servile attachment to Galen and to
Hippocrates, of the merit of which we
can have now no just conception.
In the close of this work we have many
experiments made on living animals,
in order to determine the use of the
organs, particularly with respect to
the motion of the blood, which merit
your highest attention. His merit
drew upon him the envy of his co-
temporaries, but they were at length
led to imitate him. Sylvius attempts
to correct Simpsons upon Vesalius;

as

as do also, with more candour and accuracy Fallopius & Eustachius, the former teaching the Text, whilst the latter rivals Him in composing a system of Tables, which long lay hid and were only found after ye beginning of the present Century. and they are most excellent, & should be studied by all Beginers.

We are now advanced towards 70 years of the compleat discovery of the Circulation by Dr. Harvey. But as the Great outlines of the Body & ye various organs were now tolerably well described, and its oeconomy still remaind mysterious, the History becomes much less interesting. So that I need not mention the new Anatomical Authors who published after this, especially as I may refer

to

to the Theatrum Anatomicum of Caspar Bauhine, who was remarkable for his knowledge in Botany as well as in Anatomy and who has digested the new improvements in the end of his System. Anatomical knowledge was now more general in Europe, Fabricius, Aspelius, and Casperus improved upon one another in the University of Padua, while learning was diffused from Italy to the Northern parts of Europe; and a System was published at Paris by Riolan, wch was for many years the common standard of Anatomy.

New experts were more frequent and accurate, In the 1624 we have described, the manner in which the nourishment is conveyed to the Body, By Asellius an Italian Author, The Chylopoeticus

D

to open some living dogs, observed upon the surface of their intestines & on the Membrane connecting them to the body, called Mesentery, certain vessels very different from the Arteries & Veins formerly known, When We examined ye direction in which the liquor they contd moved, We found that with the fingers We could press it forward & towards the Heart, but We met with insuperable Resistance in giving it the contrary direction. On Repeating this experiments, We remarked That the Colour of the contents varied according to that of the contents of the intestines. If the Intestines contained Water they were clear & transparent; If they contained the aliment which consists of a mixture of Oil & Water which Lines it than opacity, they were

not

not spilled, but of a whitish colour.
So that We found the liquor they contained was evidently sucked in from ye Intestinal Canal. If we review the past history of Anatomy, we shall find some traces of such a discovery, or of a Description of them in the writings of Erasistratus & Herophilus; but then they were not sufficiently prosecuted by either, and seeming unintelligable to their Contemporaries, as well as to their Successors, Asellius has the same merit as if no mention had been formerly given concerning them on account of the Lacteals was published in the 1622. and

In the Year 1628. Dr Harvey published His Work De Motu Cordis & Sanguinis in which He proves a Doctrine He had known for many Years before,

That

That the Arteries & Veins communicate by their extremities or rather That the extremities of the Arteries make the begining of the Veins. Thus suppose My right arm to present an Artery and My fingers the Branches into which it is divided, Dr. Harvey has endeavoured to prove, That those Reflected forms the Veins, or That Joining the Hand & Jointstate an Artery Corresponding with a Vein He concludes therefore that in this respect the blood is moved as in a Circle constantly and Rapidly and the Proofs he gives us of it are perfectly decisive viz. That if You make a Ligature upon an Artery, or press upon it, it swells, or Beats on the side of the Ligature next to the Heart, & not on the other

side

side, & if you cut it, the blood is discharged from the side next the Heart. But if on the Contrary, the Artery is Cut in a vein, it swells underneath ye Ligature & upon making an wound both above and Below the Ligature, that underneath only discharges blood freely, & this motion is evidently Constant & Regular, for when we feel the Pulse the strokes quickly succeed each other.

This Doctrine wch at once overturned the Theories of the time, as well as every former System, explained a great part of the Animal economy & paved the way for ye discovery of many important truths, did not fail to draw upon its Author numberless adversaries, who just endeavoured to disapprove his doctrine, but not being able to invalidate ye truth

of

of this System, They next endeavoured to ascribe it to some other Author: and as this enquiry is not without its use, as it gives us some Idea of the Practical Authors of different ages, I shall give You some account of it as far as it may seem necessary.

Two very learned Authors (Vandenlinden and Amstavain) have labour'd to prove that the Circulation was known to Hippocrates, and by quoting detached passages from different parts of his Works they seem to give some appearance of truth to their opinion. But if You consider those in the Spirit & not in the Literal translation of the Words, Hippocrates's Ideas will appear different; He believed that the Blood was not in a stagnating state

but

but in motion, He often uses the word
πλεῖσθαι for expressing that it goes
about, But then when He comes to
define the Motion, He compares it to
the Waves of the Sea; He supposed
that the blood passes to & fro in ye
same Vessels. and if He uses the
expression of Τὸ ὅλον μέγα πέρας ἔχει, the body
is a circle, He is so far from explaining
the Circulation by it, That He means
to say its Junctions are inexplicable,
That He neither could find beginning
nor end in it, so that this proves
His ignorance of the Circulation,
and what quite disproves His
accurate knowledge in this respect,
Not only does He apply the name
of Phlebs to arteries as well as
veins, but He conceives those to
be diffr. branches of ye same root

For

He struggles himself in endeavouring to
show why the one branch beats, & the
other does not. Further He says little
or no attention to the Pulse in Diseases
which a Person acquainted with the
Harveyan system could not fail to
have done. & from the want of this
I cannot help venturing to allege
that the Description of Diseases
given by Hippocrates are less accurate
than the common powerful admir-
-ation of antiquity would lead us to believe.

After Hippocrates, we find the
discovery ascribed to Aristotle, Plato,
Erasistratus, Herophilus &c. and to
these last particularly on account of the
exceeding accurate Description they
they have given of the Heart. of
its Valves or Blood gates particularly

and

and the accuracy with which they shut the cavity; and supposing they had every person does not foresee the consequences which follow from any opinion he establishes, so we are not to argue from Aristotle's showing the Nature of the Valves in the Heart, that he understood the Circulation, nay in other parts of His Works He speaks in a very vague manner of the way of the motion. Erasistratus & Herophilus have perhaps still less claim: according to Celsus, Erasistr. fancied that when the blood passed into an Artery, it was in an unnatural state, he says " Si "sanguis in eas venas quæ spiritui "accommodatæ sunt, transfunditur, febrem "fieri" He supposed with Praxagoras that the name of Artery was just, that

these

62.

These conveyed Air or Breath, & imagined that the blood rushed in because ye Spirit went out, and Theophilus more partly insists upon ye necessity of altering the names given to the Pulmonary Artery & Vein, tho they resembled the artery & veins in the rest of the body, yet he thought the Pulmonary Artery served the office of a Vein, & that the vein serv'd for an Artery, and uses the terms of Arteria venosa, & Vena Arteriosa. ie He understood that the right side of the Heart dispersed the blood to all our organs, while the left auricle furnished the Spirits, & he was led into this idea from dissecting the Heart, when he found no hole in the partitition for a Communication,

and

and on the right side he found the
vein distended wth blood, while on y^e
left the artery was empty its Muscular
power pushing the blood forward before
death. The Doctrine of Galen concern^g
the Circulation has been reckoned so
opposite to the Harveyan system, that
he has never been mentioned as an
opponent, and yet from his Writings
more facts are to be collected wth point
at a Circulation than are to be found
in Hippocrates or any other Author.
and it is matter of Readiness, as well
as Curiosity to know his ideas.

He tells us w^t the reputation of
Erasistratus & Praxagoras, who thought
that the Arteries conveyed the Spirit,
He says they convey blood, He had
found so in opening the Arteries of

living

living persons, in wh He was versant
as opening the Temp.l Artery &c
But as Erasistratus might say, that the
Moment Breathing was cut the
Spirit escapes, & the Spirit rushes
in to fill up the void. He next
ties Breathing in two places and finds
it distend.d w.th blood. So He speaks justly
w.th regard to Aneurisms, and He is
the first (not Paulinus) who divides
them into True & false, and He
observes that both are owing to the
blood accumulated in them, or spilt
from them. He next alludes to Boyle
Division of Hæmorrhoids at their extrem-
=ities, observes the Intermixture of
their branches w.th those of the veins,
& He supposes that there is a com=
=munication between them.

That

That they are joined at their extremities. He knows that when a Ligature was thrown upon a member, the veins swelled under it, following the veins to the Heart, he found no holes in the partition, according to the Ancients doctrine, and that there was nothing to prevent the blood from passing into the Pulmonary Artery: they that the Valves had a contrary effect to the Veins, that the blood passes from the Heart unto the lungs, and from them goes back unto the Left side of the Heart. Wherefore We commend the observations of Galen, we seem to perceive a knowledge of the Circulation. But We no where joins his experiments in order to determine the question of

the

the blood, He throws them out in an unconnected manner, without Due Care of the proper Consequences. For when He is treating more immediately of ye blood's motion, He says it sometimes passes from the Arteries into ye veins and at other times in ye Contrary direction from ye veins into ye Arteries. He says that the veins receive their blood by an inherent power of dilating themselves, not that it is pushed into them, but as when we open a pair of bellows the air rushes in and tho He is forced to allow that there is a motion from the small veins into the larger, as that the veins of the Abdominal Canal carry the nourishment to the Liver, yet He supposes that in general it passes

them

from the larger branches of ye veins
into the smaller, and in treating
of the Mesentery he supposes that ye
blood passes to & fro, so his ideas
upon the whole are inconsistent,
and he had by no means the
most distant notion of the true
motion of the blood.

The next to whome ye discovery
is attributed is the Chinese Physicians
When China was first visited by
the Europeans, they are said to have
described the Circulation by a word
expressive of the Circular motion
and they observed them very attentive
to the Pulse. But to this day you
will find that the Chinese Phys^ns
are so far from understanding
that regular motion, that they

feel

feel the pulse at diff.t hours in
different diseases, not supposing ye
frequency to be the same in all.

After the Chinese Physicians, the writers
of the 16.th Century have been quoted
and of them Fabricius who compiled
his work near the end of it, But all
their descriptions are to be found in
Galen, and seem to have been
transcribed from him, except that
of Casalpinus Physician to y.e Pope
who imagines that when we are
awake y.e blood passes from y.e heart
into the arteries, & when asleep it
passes from the arteries into y.e veins,
wh the conclusion from the veins
being more distended in time of
sleep, owing to the greater degree
of warmth, and to the less pressure
not

not going on so fast, whereby a greater stop is put to the Circulation in the Lungs, But he admits that sometimes blood is drawn from the veins back into the arteries, and speaking of the Valves of the Heart he says, That there are two on one side, while there are three on the other, that the blood might pass from the Heart to the Sacci Respirii, as they call the Lungs. Nor is the discovery to be ascribed to Fab. from his observing the veins with more accuracy than their valves; but he did not foresee every consequence that followed the ascertaining the right use of these, Nay where he had assigned the use of the Valves, instead of supposing they directed

the

the blood to the Heart, he says, they hinder the blood from being driven from the large trunks of ye veins into the smaller, supposing ye blood moves as Galen did.

So that the only Person who can be named as a Comparison wt Harvey, or where we find Expts made, to ascertain this point is Vesalius. From this System you will find not merely Hypothesis concerning the bloods motion, but this opinion is supported by experiments and if you reason merely on the facts he advances, you are led with the clearest evidence to the knowledge of the Circulation, yt he was far from seeing the consequences of his own observations.

Vesalius

Vesalius in the last book of his Anatomy joins Galen against Erasistratus, in showing that the arteries naturally contain blood. He not only knew that the blood was discharged from them when cut, but he repeats the experiment of tying the artery in two places & cutting out the intermediate piece. He likewise endeavours to refute Galen with respect to his idea of the cause & manner of the motion of the arteries. He attempts to show that the arteries are full because they are dilated, and not filled after they are dilated. His proof is this, He cuts an artery across, & finds the dilatation & motion to continue in the part connected with the heart,

but

but that it ceases beyond ye incision,
and lest it should be said, as a
Modern Opponent might be ready
to alledge, that by cutting ye Artery
we had deprived it of its living
power, he rejoins them by means
of a tube, & finds the motion
restored in the distant part.
Hence he shows evidently that
the artery in Debate is passive.
He proceeds upon this to observe
the correspondence between its
stroke, & ye Contraction of ye Heart.
He describes Respiration as taking
place when the Heart is laid in
view, that when the heart contracts
the Arteries swell out. He knew
that a great quantity of blood
is lost from an Artery on a
short

short space of time, He represents in
His figures the branches of ye Arteries,
mix'd wth those of the Veins, and
supposes a comm^n takes place
between them, He knew that
when a ligature was drawn
around a vein it swell'd under
the ligature, & having the vein
into the Heart, He describes the
situation & use of the several
Valves, & w^t Galen He denies
there is holes in the Septum.
so He concludes that the blood
passes by the Right side of the
Heart, and by the Pulmonary
Artery into the Lungs. He still
proceeds further, and performs
a very curious experiment, w^ch
has been ascribed to Dr Hook

For

(For the experiments of Vesalius have been strangely overlook'd by Anatomists and he has not even been quoted as a Conjecture of Harvey) He laid open the Thorax of a living Animal & observ'd that ye lungs collapsed, and that after this the motion of ye left side of the Heart ceased, because ye blood was hinder'd to pass; and as a proof that this was ye reason he tyed a tube in the Wind pipe and inflated the lungs, when he observ'd the Animal revived, the motion of the Heart was Restor'd, and it contracted as before with violence, the motion of ye arteries corresponding to it. Now from all this we are led to conclude that there must be a Circulation,

For

For if we fairly establish the facts
that the arteries contain blood, that
the blood is moved in them with
violence & rapidity, that ye Heart
throws a great quantity into them,
that it flows to the Heart, & evidently
thro' the lungs, and if we subject
to the eye sight the lesser circulation
we shall understand the greater,
and yet so far is this from being
the case, that immediately after he
proposes objections to these points, and
afterwards he tells us it is needless
to make any, for that ye motion
of ye blood in them is sufficiently
understood, namely that it moves
from the trunks of ye extremities
from the Heart outwards, And,
what is almost incredible, he

is

is Himself struck with an objection,
you will ask, says He, Why don't
the veins beat? but He answers
that, by saying, This owing to ye
thinness of their coats, & in ye
same page, He endeavours to prove
that the pulsation of the Artery
does not depend upon the coats
but upon the stroke communi-
-cated by the Heart. So we certainly
cannot find in the History of
Physic, a more clear proof of the
Danger of Hypothesis, than by acqui-
-escing in it we are prevented
from investigating truth by Obser-
-vation or Experiments, & where
we have done so, of drawing ye
proper consequences. So ye honour

is

is evidently due to Harvey, of having
first fully disclosed the manner
of the Circulation, and it is likewise
plain that he had more merit
in seeing the truth, than of prejudice
in favour of the Plausible system
of Galen, than if he had made
the discovery without having read
or known any thing on the subject.

Lect 38

I gave you an account of the history
of Anatomy from the first origin
of the Science, till the discovery of
the Circulation by Dr Harvey: &
I took that occasion of saying
before you all that had been
known in different ages on this very
curious subject, as being not only
entertaining

entertaining but instructive &c.

We now find learning diffused from the universities of Italy & France, over the other parts of Europe: and in no long time publick societies were instituted, of wh the Royal Philosophical Society of London, is the most ancient wh includes Medicine in its plan. In this it was imitated by the French & Germans, and Now we find such societies established in almost every County & Capital of Europe: and in the space of about 30 Years important discoveries continue to be made. Particularly the Observations of Doctors are confined, not only in Quadrupeds, but even Human bodies the bodeals are seen, wh was a matter

matter at that time of the utmost
moment, as the reality of Vesalius's
discription of them had been called
in question by many, particularly
by Harvey himself. at the same
time Pequet traces the Radicals
to the Thoracic Duct, of wh. too only
an obscure discription had been
given, and the use of it was not
known. Soon thereafter, but
within the 30 years Harvey pub=
=lished, a complete System of Vessels
was discovered by Rudbeck, and
Bartholine, wh. from their valvular
structure, and the Lymphatic
appearance of their contents, were
named Lymphatic Vessels.

And not only were the principle
organs of the Body now known, but
its

its oeconomy was in a great measure disclosed. The distinction was made Praxagoras between the arteries and veins, and now the course of ye blood and of the Chyle was known; and the proper office of the Nerves was pointed out by Herophilus & Erasistrs. We now therefore find that the pursuits of Anatomists soon took a very difft turn; and instead of endeavouring to describe yt larger Masses of the body they threw light upon its functions by new and curious experiments, particularly Malpighi Physician to the Pope, and Ruysch in Holland. By dissection we only discover the surface of things, but they now attempted to unfold their texture.

By maceration they loosend the texture of the softer parts, & give

a

a degree of Summetst to the Softer. They noted the changes induced by Disease; They compared a variety of Animals wt one another; They injected coloured liquors into their vessels, & carefully applied the Microscope, so that they opened up a new field of minute Anatomy wch is not only highly curious, but extremely useefull, and Ruysh showed a more beautefull plexus of Vessels than had been conceived by former Writers. But the number of books is so Multiplied that we had better more time, to give a particular of them, than We can bestow. So I shall proceed to select such of them as I imagine are the most useefull & Entertaining for Your perusal, and tho' this may not afford much entertainment the knowledge is so very necessary to beginners, that I hope it will

Drawn

Draw their attention. It is evident that in every science, Books must be of very considerable moment. Tho' it must be acknowledged that in words even assisted by Delineations, it is impossible to convey such an idea of the Structure of our body, as is necessary in our practice, There are many things wch Part of the Painter cannot comprehend, it is difficult to hit the true colour and it is impossible to give the hardness & consistence of the different organs. In most Sciences Teachers find themselves at a loss to point out to Beginners a proper system, and for evident Reasons. Few are qualified for teaching any science in its full extent & while fewer are willing or have leisure to

undertake

undertake the task, and in Anatomy
there is a double difficulty, the Anatomist
requires the assistance of a Painter
skilled in Dissection, & highly eminent
in his own profession. so that no
person in the present Century has
attempted to give a description of the
body in its full extent. so we have
recourse to a number of books, &
to take the Descriptions of one person,
and figures from another, to whom
perhaps the other paid no regard.
but, tho' for a compleat knowledge
of the art, we are obliged to have
recourse to many books, yet at
first beginners should use but few.

Before they enter upon a course
of Anatomy, they would wish to
acquire some gen[l] knowledge of
it, and this may be tolerably
well

well done by a perusal of Chesselden's work, where the descriptions tho' short are tolerably accurate, & they are explained by very distinct figures. The 4th, 5th & 6th editions are more valuable than the former, after getting a genl idea of the art, & about to attend a course where the parts are dissected minutely. We would apply to some larger and still more accurate work, formerly Verheyen, was recommended, but he is now a dear & subtle, & from his ignorance of the English language, he was even unacquainted with the Material improvements made at the time he wrote, Nor can I venture to recommend this book tho' it has been repeatedly new-modelled by Palfyn, Boudine, and lastly by Petit of Paris: for we

like

Will find it a pathetic work, and you would imagine that the figures of the Muscles, for instance, were rather from a block of Wood, than from a dissection of the Human body. Besides as We have no translation of it, those Gentlemen who are unacquainted with the French language need some other assistance, and yet last upon the whole is ye Anatomy of Winslow. Who is by much the most correct in point of description that has ever appeared, and in wh regard is constantly had to ye situation and connexion of the organs, which had been shamefully neglected from the days of Vesalius downwards. Will however there are several objections wh Beginners will be apt to make against the Human that the

The dissections are exceedingly minute so that it is difficult to follow them. Of this Winslow himself was sensible, and he proposed to have illustrated his descriptions by a System of Tables, wh never have been finished.

Next he describes the body merely as an Anatomist, without considering it as the foundation of ye practice of Physic & of Surgery; so he is equally minute in matters of small consequence as in others of ye greatest importance. And the French writers are but little acquainted with Marks of Malignity & Danger, by wh the intimate texture of our bodies are unfolded. Upon the whole as far as he goes, we find his work correct. it is translated by Douglass into English, which is printed in 2 Vols & we have an Edn in 8vo

After

After We have considerd the full
discription of any organ, we wd surely
wish to recapitulate the mat. circum=
= stances, and this You will find very
well done in Winslows Compend of
Anatomy. His Tables are discriptions, in
wh You have the Material circumstances
of each material organ enumerated. For
I can scarcely recommend instead of
Winslow, the work of Lieutaud. For tho we
are told by the Author that they were
compiled after He had repeatedly compd
Winslow with Nature, We find Him
in many respects deficient. I have
already observd the difficulty of
understanding discriptions without
the assistance of Tables, therefore along
with Winslow, it will be proper to
peruse some figures. Formerly the
work of Vesalius was universally
recom.

Recommended, and You observe y^t figures
are very Elegant; yet altho' considering
the time in wch it was composed
this Work is Praise-worthy. He shows
too much action of the Muscles wherby
He has misled many of the Painters.
In some places too, ye parts of ye
Animals have been substituted
instead of the Human body. I wd
therefore in place of Vesalius recom^d
the more correct & useful work of
His Coemporary Eustachius, & You
see here this original Tables, wch
I said were in danger of being
lost, & were only preserved by ye
care of Lancisius. At first sight
we are convinced that the Tables
of Eustachius in point of execution
and elegance are infinitely superior
to those of Vesalius, Nor can
they

they will fail to be so, from the
manner of their construction. First
He places before the Painter a Skeleton,
then He makes a dissection & instructs
Him, attends Himself to the connexion
of the new muscles, & instructs ye Painter
how He should transpose those Muscles
upon the Skeleton, without drawing
the parts exactly as He lay before
Him, Perhaps to conceal this art, He
find another fault in the System of
Eustachius, That instead of beginning
with the structure of the basis, He
ends with it, so that in studying
His tables We ought to reverse his
order, yet such attention is given
to the true situation of the new
organs, & many more of ye minute
Bloodvessels & Nerves are traced out

such

such care, that Anatomists have
agreed to prefer these Tables to the
more Modern works of the same kind,
You will peruse the Copy published
by Albinus, with a very full and
correct explanation, & the last and
best edition is in the Year 1761.

We throw proper light on the
Structure by joining to ye System of
Eustachius, that of Boerhaave, with y^e
Assistance of Mr Cooper. For tho' the
real situation of parts is very much
overlooked, & an appearance of Elegance
rather than Accuracy studied, yet it
contains many things that is not
to be found in Eustachius, and in
consequence of the great elegance of
the Painting, and that ye Drawings
are of the Natural size, We can
judge of them more accurately

than

than it is possible to do from Cadavers.

If we mean to prosecute the real Branches of Anatomy with accuracy a much greater number of bodies becomes necessary & those I shall explain in the order I reckon most fit for an Anatomical course

We begin with the Basis in its perfect state, & here we have very sufficient Assistance, first to study the Dry bones, the principle part of ye basis, & here I may venture to recommend a small book published by My Father, as being sufficiently accurate in Anatomy, & every where pointing out an application to practice, & I venture ye more readily to recommend it, because of late years Mons. Sue, Demonstrator to the Royal Academy of Painting at Paris

Paris, has translated this Work in a more sumptuous form than was Necessary, and he explains ye Discriptn by figures that are highly elegant, and in the disposition of these, he is guided entirely by his Taste. I shew You the difft pieces of the Thorax, where each part has the true shape, and the whole is represented togr so very elegantly & justly as almost to resemble nature itself, indeed nothing that painting gives is wanting here. But if You mean to study the Osteology wt the most scrupulous Anatomical accuracy You will have Recourse to the Works of Albinus, who in his book De Skeleto humano, gives a most minute discription of every part.

with

with a reference to Tables, which
in point of elegance nearly resemble
those You have seen; and in point
of accuracy perhaps exceed them, and
they are all of the Natural size.

To examine the manner in which
the bones are applied to one another, &
tied together, so as to fit them for motion
We have very excellent assistance from
Dr Webbright in his Work, published
at Petersburgh, under the title of Syndes-
mologia &c: an Account of the Ligaments
but which includes likewise the Cartilages
and other substances relative to the fresh
bones, and the descriptions are certainly not
only full, but accurate, & the figures are as
elegant as the subject required. For these
parts, You may also read Winslows treat-
ise on the Wet bones. On the Basis of
the Body this very splendid Work of

Mr

Mr Cheselden used to be studied, but it is now in a great measure laid aside, not only as being less accurate than Sue, or Albinus but that the descriptions are very superficial not to say, absolutely trifling. The principle use we can now make of the Work, is the examining of the latter part of it, some Delineations of ye bones in a Decayed state, where You find a number of very curious cases of this kind

From the bones we are Naturally led to the Muscles, & there besides the Work of Winslow, we have excellent assistance, just, from Dr Douglass, in a very distinct & accurate piece, and wh is at the same time very concise, & afterwards from Albinus in the 1736. in his Historia Musculorum; and till the latter Albinus endeavours to complete this Knowledge by very elegant tables, & as a basis to these He gives what was wanting in the books I have shown,

Three

Three figures of the Skeleton, & the Skeleton and Tables in wch the Muscles are re=
=presented are constantly kept in one situation, whereas situation & scale were too much neglected by our Anatomists: and upon the whole, This is one of the most beautifull & Correct works that has ever appeared & will in all probability stand the longest the test of time, Yet some things are wanting wch might render it more usefull Viz. He has not thought it incumbent on Him to re=
=present the several tendenous membranes called Aponeuroses, wch are closely connected with the Muscles, & indeedlly makes a part of them, and it is of real use in practice, for explaining the action of the Muscles, that their situation shd be well understood — From want of due attention to this matter, after the Aponeurosis has been removed we find in the Tables of Albinus, the

The fibres of the Muscles represented too
smooth, for upon detaching of Aponeuroses
we cut thro' the fibres of the Muscle,
whereas in some places the fibres are
represented longer than they will be
found in nature. There is another
circumstance wch Albinus, tho' he
begins with the Skeleton, immediately
presents us with the outermost layer
of Muscles. Now tho' in dissection
we must pursue a mixed method, as
we can neither analyse the body, nor
yet put the parts in order, yet surely
this in tables is very practicable, so
what Albinus has for his first
table of the Muscles, should have
been the last; he should first
have given the Skeleton, and then
the Muscles in succession layers
upon the Skeleton 'till all was
compleated

compleated, and that is the best way
of studying them. For a Beginner who is
not much us'd to paintings may cut
them down, immitating the disposition
& lay them over each other, as the body
is constantly preserv'd in the same situ-
-ation. And as Albenus has unluckily
Re-printed his book, with references
to his own work, instead of many his
large work, You may read Douglass
w^t the Tables of Albenus, where You
will find much easier followd. Sunny
instead of Albenus, Recourse was had
to the Tables of Mr Cowper, assisted
with his descriptions, But I show you
them now, not on this account but
that intimacy with the Tables We
find other Parts Represented, for too
little attention is paid to ye Real
situation, and We find the muscles
detached, when the only conclusion
we can draw is w^t respect to y^e

Strength

strength of the Muscles, without knowing their real use, and Cowper imitating Vesalius, has much exaggerated their action, He has shown more Muscles and a greater swelling of them, than are ever employed.

Having now studied the bones & Muscles, we are fully prepared for Judging of the situation, & connexion of all our other organs - and now We have recourse to the descriptions of Winslow, with the figures of Eustachius and Bidloo, by which We learn the several bowels & their attachments, the Glands, & the organs of the Senses.

When We are acquainted with the principal parts which compose our body, We are ready to enter on the examination of it as a System as having a communication formed between its different parts, by means of the Vascular & Nervous systems.

And

And beginning with the Heart as the prime Mover, We would first study the anatomy of that organ. To understand the structure & office of the Heart, We have very large assistance, & very excellent at the same time, from Mons Senac, Who has given us a Treatise De Corde en 2 Volumes 4to. The first is employed in the description of that organ, whilst the other is employed in its Physiology & Pathology. The Anatomical part is rather more diffuse, & prolix than was necessary, but He manages his subject with much Spirit and Address, that one is led on insensibly both in the Physiology & Pathology. We would then trace the course of the blood, & upon this subject We would look into the original work of Dr Harvey, wch is extremely short, but very distinct,

His

His arguments are clear & conclusive, and fully sufficient to prove what he undertakes; tho' still later we have further proofs thrown in from Anatomical Injections, the situation of the Veins and Valves making the blood pass from one to another, & seeing the motion with the Microscope. &c

In prosecuting the particular Branches of the Blood Vessels, We would first consult Eustachius, & in order to know them more minutely, We wd consult the Tabulæ Anatomicæ of Dr Haller, But as He did not intend a complete system, little regard is paid to situation or scale but in one figure the parts are from the Adult, while in the next they are perhaps from a Child, neither are figures in a proper order for You have the Arteries of the Heart perhaps next those of the Belly, or some other

part

part, shall however from ye numerous
of the figures & descriptions this Work is
highly valuable. I have divided it
into 2 Vol^s. which shd be universally
practised, otherwise you are under a
necessity of turning the leaves, and
the explanation should be in a smaller
form. We would trace back ye blood
in the Veins, by the tables of Eustachius
of Bidloo and of Cowper, with the
descriptions of Winslow.

From the Circulating System we are
led to the Absorbent, or Imbibing system,
I observed to you, that ye Lymphatic Vessels
were discovered about the middle of last
Century, and from their resemblence to
Veins, they were supposed to be derived
from the Arteries, but we shall find
they absorb their contents from ye Seat
Cavities, as you will see in a small
Work I published in 1787 at Berlin.

Your

For an account of the Sm[all] branches I might refer to the original papers of Cruikshank, and Bartholine, and to the works of Nuck on that subject. I cannot however venture to recommend those, as I suspect many of their descriptions are imaginary. and I would put into Your hands a Work published by the late Mr Newton, where You have a tolerable full view of the Lymphatic System, but on too small a scale. Formerly I used to lecture the preparations wch I shall have occasion to show You, along with engravings which I shew'd when Mr Newton himself attended Lectures in this place. At the same time I must do him the justice to observe, that his descriptions are not taken upon trust, but He has traced them by his own labour & dissection, & in several respects He has followed the small branches in some places

more

more carefully than has ever been done before.

It still remains, to complete ye General System of the body, that We examine ye Nerves. For when We view the motions of the body, & consider the powers we posess by our will over the Vol^y^ Muscles, as well as the Motions of the Heart and Vascular System, it appears necessary that some parts should make a communication between the living & Corporeal, which is done by the Nerves. On this subject the Work of Vieussen was generally recommended formerly; But He represents them simply without any connexion wth the other parts, so that His figures are of little use in Surgery, and the communications which them, wth the points and, will not illustrate the Theory concerning them so much as has been supposed, since the Sympathy wch takes place is not owing to those communications, but

but must be referd chiefly, and in many instances solely, to their connexion at their origin. Instead then of studying these parts, I would recommend first, the Tables of Custochius & in some particulars, those published by Dr Meckle at Berlin. In 1757. when I was there He had Tables of them all; and only delayed ye publication till He had more opportunity of comparing them with Nature.

After We have traced the Vascular & Nervous Systems to any organ, We are fully prepared for dissecting its intimate structure, which depends on the Modification, & disposition of those principle parts, We therefore conclude our examination of each organ, by attending to its structure in various ways. But here We are very much at a loss for assistance. In the descriptions I must refer

to

to the works of the Learned Dr Haller,
To his Primæ lineæ & Elementa
Physiologiæ, and to explain his
Discriptions, We must haive recourse
to the figures given By Ruysch of
the structure of the sev.l Viscera, and
which are represented in a very
unconnected Way without the
least regard to Systems. In some
things the Works of Malpighi throw
light upon the subject, particularly
in the Comparative Anatomy, and
to these We join the Plates published
by the learned Albinus, in his
Annotationes Academicæ, But as the
explains only a small number of
the organs, I must refer here to the
preparations which I shall demonstrate
in the Course.

Some few organs require a more
accurate discription, from the number
of minute Humans parts in their
composition

composition. For the Eye I refer you to the single book of the late Dr Lin where the sev.l parts are discribed & painted. Unluckily he did not live to publish the Physiology of that organ, he confines himself merely to the discriptions. For the structure of the ear, if we are not satisfied with the very distinct work of Dr Burney we may throw some further light on it by consulting Valsalva, Casabon, or the later authors Columnus & Scava.

After discussing the structure in its perfect state we would investigate its Evolution, the manner in which the several parts are formed, and the appearances peculiar to the Foetus state. And here we would begin with the curious observations of Dr Walker, upon the formation of the Bones & of the Chick. But it is to be regretted, that we have only

His

His descriptions in Words, without
assistance from figures, and without
which it is not easily understood.
After examining the Primordia, We
pursue the basis of the body, in an
excellent Work of Albinus, his Osteogenia
in which the bones and Cartilages
are presented with great elegance. For
the organs proper to the Foetus, We
have a valuable Work by Dr Fries
De differentiis inter Foetum natum
& nascendum.

After thus making ourselves acquainted
with the Anatomy of the body in a
sound state, We would investigate
the changes produced by Disease,
in the works of Morgagni & Lieutaud,
but particularly in the former, whose
accuracy may be fully depended on.
The Work of the other, tho later, is
very defficient in point of accuracy
Not only in the Symptoms, but

likewise

likewise in the dispections.

Having now fully examined the Structure & changes produced in the Human body We would make some comparison between it and other animals. And first We will understand from the System of Linnaeus, the Genl division of them into Classes, to enable us to select the proper examples. For Quadrupeds I may refer to Buffon, and for the dispection of the larger Animals to Blasius, and to the Works of Valentine on the same subject. With regard to insects, You will meet with many curious Objects in Swammerdam of last Century. To point out the application which may be made from these Objects I find Myself at a loss for a proper Work, and am Obliged to recommend a very imperfect one, Notes that were

taken

taken from My Father's Lectures
under the title of "An Essay upon
Comparative Anatomy" where there
is great room for additions as well as
for many corrections.

We next proceed to the Surgical
part, & as the best system on this
subject, I find no difficulty in recom-
=ing the very full work of the late Dr.
Heister, who has also given figures
sufficient to give a notion of the
shape of the several instruments, we
are to employ, & the manner of using
them. When we have considered
the subject at large, we might recap-
=itulate what may be found there
by perusing the Surgical institutions
of Platner, or a still later book by
Ludovic, which is composed after
the latter had been in use to Lecture
several years on the work of Platner.

Those

Those who study the Practice of Physic without Surgery, may content themselves with consulting either, and I would more especially recommend the Works of Plalmer on account of the singular beauty & elegance of his style.

But before we can enter on the Practice of Surgery with safety, there is a necessity of having recourse to a Variety of Authors. For when Heister published, Practice had but lately emerged from a crude state, and the simple method now used in the treatment of Ulcers, & especially of gunshot wounds, was then but little known, and of late years various improvements have been made, particularly by the French Surgeons. In the Medical Essays there are many singular papers by Mr Pratt, & many measures wch he proposes there, have been adopted

adopted by the late Surgeons. We have also many things relating to Surgery by different hands in the Memoirs of the French Academy and several detached pieces by Le Dran, Pibrac &c and of late years we have in this island a very good Anatomy book by Mr Sharpe, whose descriptions are simple & correct, and the figures tolerable figures of the several instruments that are necessary. We have also on this subject the Works of Pot, Warner, Gooch White, Broomfield &c and one lately by Mr Hill.

Lect. 4th.

As I propose to demonstrate to You not only the Structure of the Body, but to explain the use of the several organs, and point out many of the changes produced by disease, & on all occasions to consider this course as a foundation of

of practice, I mentioned the necessity, before entering with accuracy on the particular parts, of giving to beginners a general idea of ye oeconomy, from the dependence which each part has upon another, & upon the whole. You surely understand me, That at present I am only to attempt a superficial explan^n & I shall take very little pains, in demonstrating the several facts, a genl notion of them will be sufficient. and instead of anxiously seeking out the method I wd consider as the best for a system of Physiology, I shall follow one that is perfectly simple to which we are directed by Nature herself, & which leads us to overlook the circumstances of smaller importance, and to direct our attention only to general views.

The

The Vegetable kingdom in common with the Animal, live, grow, & I would venture to affirm, in a certain degree feel, But you have all surely observ'd that every animal without external impulse, spontaneously performs certain motions, & these are done with a wise & useful purpose; the animal will, or by volition is distinguished from the Vegetable. So to the body is connected a principle of Life, superior to matter.

The Bodies of Animals, consisting of a Mixture, & due proportion of Solid and Fluid parts, these must be in a constant state of change; the Fluids dispense, the solids are abraded. So to prolong life, we see the necessity for a fresh supply being continually made. And, to enable the Animal to attain what is necessary for it, it must be provided with the Organs of sense, of which We possess five. And whether

from

from an ignorance, but not being able to conceive any additional sense, or that other Animals do not possess it. This seems to be the greatest number of senses in the Animal Kingdom; & in many Animals there is a defect of some — Next, That the Animal may reach what its senses & Judges may be useful to it (for few are so happyly situated as to receive their nourishment from the surrounding element) It is necessary that the Animal should possess the Loco-motive power, should be able to transport its body from place to place. And to fit it for this we must suppose the necessity of a basis, a somewhat to support it, and give attachment to the softer parts of the body, which in our frame we call the Bone. And in order to ease us of the unnecessary load of bone, and

to

to extend the surface of its sufficiently
for the connexion of the other organs, the
Bones are made hollow. I shall
have occasion to observe more particularly
afterwards, that by this means also
the Bones are rendered stronger, But
the evident purpose is, That a broader
basis is given, We rest upon a larger
surface, and there is more room for
the attachment of the softer organs.
Next, it is necessary that the Bones or
Basis should be divided into a great
number of parts, or We observe a
great Assemblage of Bones, which are
fitted to each other, that our Motions
may be such various, and in all
useful directions.

Next, where the Bones, Joints are
placed, and where they are intended
for play upon each other, it is necessary
that some soft substance should
be

be interposed to prevent too great a degree of friction, hence when you examine the end of a Bone, in a recent subject, you find it tipped with what we call Cartilage or gristle.

If Remotion of the part, in a great degree be dangerous, & considerable flexion can't be made with safety, We find that the Bones are immediately tied together by Cartilage, as in a young subject, Where the Cartilage connects the ribs to ye Breast-bone, or in this way the several pieces of the back are connected to each other.

But if a larger degree of motion be safe, & at the same time necessy & convenient, We find the Bones merely tipped with Cartilage. And when We examine ye Cartilage We find it solid throughout, there being no occasion to ease us of the load. This substance being Specifically lighter than bone, & to prevent them from

from sliding off one another We find
them tied together by a strong membrane
call'd Ligament and this serves to
confine a liquor that Lubricates the
extremities of the bones. Thus We observe
the Basis of the body fitted for being
mov'd. To give it motion its remains
only that Contractile organs should be
connected to the different bones, stretch'd
from one to another and These we call
from their Office, & Power of Contraction
Muscles; which are pieces of flesh
regularly & beautifully dissected into
parts. And supposing the Muscle
to possess the power of shortening itself;
the most moveable bone will be drawn
to the more fixed, that the Muscles
may play, We find them soft, succu=
=lent, therefore weak, and for Force a
vast number of Threads or fibres
are required. From this you perceive
the

The use of the hollowness of the Bones,
that by encreasing their surface, it
gives room for the attachment of the
Muscles, for their origin or insertion.
Next, suppose a Muscle is intended to
move My forearm, You will observe
that it may be derived from ye whole
extent of the Arm bone, but the other
extremity must be inserted very near
the joint, for if you suppose it had
been to any greater distance, upon
drawing in the forearm, the Muscle
wd have slacken and lost ye thing
of a bow, upon throwing any thing
out of the arm, and the effect of the
muscle in a great measure lost.
so most of them are inserted near to
a joint. But as there would not
have been room there, for ye insertion
of so many of the immediate tendinous
Muscular fibres, we procure the
necessity

necessity of a further interposition of a
Chord, which shall collect the Muscular
fibres, & join them to the Bone, and
this is done by a Sinew, or as Anatomists
speak a Tendon. and these are to
be considered merely as the Organments
of the Muscles, as serving the purpose
of a Rope to a number of Men, when
moving a large piece of Wood, where
there is not room for all of them to
apply their hands. Next, you will
consider that many of the smallest
Bones, need to have the largest motions
as the Toes & fingers, yet there is not
room for bringing sufficient muscles
from them, or near the same that
a Tendon will be obliged to pass
over several Joints, and to prevent
the danger of the Muscles or Tendons
from starting out, they are tied
down by Sheaths, whereby a muscle
with

with a very small degree of Contraction is enabled to perform a very large motion, because the Tendons are but little shortned, when the Joints are bended. Thus if the Muscle shortens an inch, the extremity of the Tendon may carry a bone thro' a space of several inches.

In this way then we find the Machine fitted for performing motions and from attending to the situation & Connexion of the Bones & Muscles, the manner in which all our various motions are performed will be readily understood. If we mean to go towards any substance You will find the manner of doing it perfectly simple & evident upon the slightest reflection. First We endeavour to see one part of the Body, that another may at pleasure or liberty of motion be the

Left

left, and the flesh being thereby brot into action, the limb is drawn upwards; & then allow the body to sink downwards the left which is brought forwards, acting with the muscles of the other side, the limb being now more fixed than the trunk by the additional weight; so the body is brot forward, & the weight gradually thrown on the left leg whereby the right is at liberty to repeat the step.

In this way the animal approaches the substances necessary for its goods, By the assistance of the teeth, it tears it to pieces, and by the action of the jaw it communicates it still further; and the internal parts of the mouth & fauces, the tongue & throat being Muscular organs, by the same Muscular power it is conveyed within the body. In the throat the fibres are disposed in a circular manner, & a contraction of one fibre quickly succeeds that of another, the

The food is conveyed into that Receptacle
We call the Stomach of Animals, wch
is placed in the Abdomen, and this
Receptacle will serve as a further
distinction between the Animal and
Vegetable Kingdoms. For all Vegetables
Draw in their Nourishment by
invisible pores on their surface,
whereas all Animals, even a Oyster,
however conveniently situated for
Receiving its food from the surface,
yet Receives it into the Stomach.
We next find that the Stomach besides
possessing Skins or Coats that contain
the Aliment, consists of a Muscular
part from it the first continued the
Alimentary Canal unto those organs
the food is received, Next, We readily
understand the manner in which
the Useless & fæculent parts may be
discharged from the body of the Animal.
The Contractions of the Intestines being
continued the Contents are pushed

Downwards

Downwards. The Morsel of food undergoes very considerable changes, it is not merely dissolved & thereby fitted for entering the body of the Animal, but it must be rendered like the Animal, safe to be received. Hence in explaining the changes it undergoes, we must keep in view a variety of circumstances, not only the Mechanical division, the changes by Cookery, Mixtures by Drink, Liquors in the Mouth, & Stomach acting as Water, over the mere effect of Heat, serving to soften the food, but we are likewise to have in view, a dissolution which is made by the Liquors that are poured out from the Stomach, & various changes wh it undergoes by a kind of Fermentation, whilst at the same time a quantity of liquor is continually added as it descends in the Intestinal Canal, We suppose then the food dissolved

and

and rendered like the Constituents, The
fæculent part pushed thro' the body by
the power of the Muscular fibres of the
Stomach & Intestinal canal, whilst the
useful parts undergo changes from the
Animal liquors added to it, and it is
exposed to the large surface which the
Stomach & Gibe necessarily form, and wch
is increased in a curious manner by a
number of Rugæ or Valves, so presents
itself to a vast number of mouths, or
open Vessells, fit for taking it in, and
the process used, to have the Nourishment
from the Stomach & Intestines into the
Constitution, and to attend to the manner
of its reception. Here you will readily
judge it necessary that we should
examine the appearance by dissecting
living Animals, after giving them food,
and when we do so the food Vessels
upon the surface of the Gutts, running
alongst that Membrane called Mesentery
and

and that these contain a fluid, like
to that within the Stomach and
Intestines. We can vary the colour
at pleasure, If We pour in Water, the
Vessels become pellucid, If Milk, they
appear White, and if We use other
liquors the Hues can be still more
varied; but as for Common they contain
a Mixture of Oil & Water, the principle
of which our food consists, The Liquor
appears White or Opaque, & Hence these
Vessels have been named Lacteals.
Besides this proof of their origin, that
We can alter at pleasure their appearance,
When We examine the course of their
contents, We find that it is from the
Intestines to the other parts, and We
cannot reverse the Motion even by
the strongest pressure, for within
these vessels there are Floodgates, wh.
make an insuperable resistance.
After proceeding so far if We were
merely

merely to speculate upon it, Without prosecuting the matter by experiments, We should find ourselves at a loss to determine the manner in which the Lacteal vessels end, and at first sight We would suppose that the upper parts of the canal, served the upper parts of the body, & so on, and in some few Animals I have observ'd a Distribn of this kind, particularly in a small Worm, wch is frequently found in the Liver of Sheep, & wch feeds upon bile; from the Mouth of the Animal there is an immediate dispersion of ye bile to the different parts. But in Man & in other Animals, when We pursue the Lacteals, We find that ye smaller branches join into larger, and at length very considerable trunks are formed, & there is a communication of one branch with another that seems

Distant

Distant from its but at length they are
all collected together into a Trunk. In
their whole progress these Vessels are
provided with Floodgates, and you now
have the proof before you, where they
are filled with Quick silver, for there are
no ligatures to compress the Necessary
Must entirely to the Valves. They are
all filled from the Gutts, & keeping the
preparations with the Quick silver does
not fall back again. May on taking
a neare look, when filled w^t Wax, we
can see the joints, Also pursuing
the Radicals, We find they all unite
in the Back part of the Body, and
from this place, a pipe is continued
Running upward & near the Spine,
along the back part of the Chest, or
Thorax, & hence they named that
the Thoracic Duct, and we find
this duct terminates in the meeting
of

of two large Veins, Viz. Where the vein of the neck, or Internal Jugular, meets with the great Vein of the Arm named Subclavian, from its running under the Collar bone, at no great Distance from the Heart. Here we observe the Nourishing Liquor, wch Anatomists call Chyle, is intimately blended wth the Mass of Blood. And as we know that the Nutritious fluid must be continually passing into y Constitn for the support & Nourishment of all the parts, We now perceive that from this part of the body there must be passages leading to all others: and We learn a second fact, That the blood does not stagnate in the Vessels, but is in a constant state of Motion, and I find it will be more necessary before going on to describe the course of these Liquors in the body

body, to give You some Account of the composition of the Blood, that those we have in the Common Systems of Anatomy are not merely imaginary, but have the appearance of being supported by very Decisive Arguments.

You all know the general colour of the Mass of Blood, that it is red, and I take it for granted You have all seen the Spontaneous of it into parts, Serum and Crassamentum. Therefore We are at first sight ready to imagine that the several parts of the Blood are Essentially different from each other in every quality, yet if You look into Boerhaave, Haller, De Haen &c. You will find an opinion entertained, that every One part may be converted into another suddenly, by a mere Dis=
=cretion of parts, and the ground work of this opinion is taken from the Works of Lewenhoeck a Dutch Writer

of

of last Century, who was a very carefull
Observater with the Microscope. He
pretended that he observ'd that Round
parts, commonly called Globules, were
composed of a number of small Globules,
& even pretended to assigne the number
to 6, and that in the course of the
circulation or otherwise, the Globules
seperated into 6 parts, it formd the
Serum, or colourless part of the blood.
He went a Step further, alledging
that the Serous Globules are compos'd
in like manner of subordinate Lymph-
atic Globules & so on, for sev. Descents
series. His observations were readily
Received, from the accuracy he had shewn
in many other particulars. Many severall
ingenious Physiologists, without absolutly
to Experiment but considering ye most
fit way of Composing a large Sphere
out of smaller ones, as Dr Nieder found
that

that the Spheres make the most complete figure — Still further credit is given to this opinion in consequence of what has been said by Dr Haller & others who assum that they have seen the separation of the Red and colourless parts. Perhaps without further circumstances the fallacy of Leuwenhoek's Experiments wd have been very early detected, but this opinion seem'd to correspond with several other Phenomena. Boerhaave tells us, that on exposing the blood to a damp place, the red colour disappeard and it was supposed that every change effected by Leuwenhoek, could be seen dayly in practice; for if a Purgative is given, a colourless fluid is evacuated in great quantity, & the Patient becomes pale, as if the red globules had been broken down, & discharged in that state

State by the Purgative, &c. &c. &c.
is spoke of, and I do not find that the
appearance has been explained to us
fully, in favour of the same opinion
viz. If by a bruise blood is extravasated
under the skin, you have observed
that in a short time the part becomes
of a yellow colour, & at length the whole
extravasated fluid is taken up, as if
the breaking down of the globules
formed the yellow tint, & the breaking
down of the serum again gave
such a tenacity to the fluid, as to
enable the absorbents to receive the
whole. — Now, notwithstanding of
these appearances, & experiments
in favour of this Doctrine, I can
give a clear & full refutation of it
1st. I have repeatedly examined
the circulation in living animals,
without

without ever perceiving the least appearance of small globules forming the larger, or of a separation being made in any shape of the larger into smaller. & I can only explain what Dr Wells & others have related by supposing that too strong a light has been thrown on the Object. For if you examine a small vessel containing Red Globules, with the light of the Sky it appears Red and opaque, but when the clear light of the Sun is condensed by a Speculum, it has more the appearance of being transparent. Now, altho' it sometimes happens, that Glob.r parts are mixed with the Serum, yet We cannot discover Globules in the Serum itself, but if We mix the Globular part with Water

water, or with Serum agitating it, in order to break it down, we cannot take away the Colour, May there has been some unaccountable mistake in the Experiments of Boerhaave and De Haen, in finding that the red colour of blood, keeps in a moist place, entirely disappears, for I have kept it Months in a warm place, both with Circulation and Dilution, and I always found the colour remained but that it grows darker, like the Grounds of Coffee. Neither can we by agitation form from the Serum a angulated Globule, and what is an Argument there Exists, When we mix the red Globules with pure Water, & agitate the Mass, the Colour remains, but the Globules disappear and hence we see pure

that

that the colour & situation of parts have no immediate connexion. And this observation explains some other things by wch Authors have been misled. Thus we surely can't suppose that when a Purgative is given that it shall alter the whole mass of blood. We see a paleness produced but surely we cannot suppose that it depends upon the Evacuation of the Serous blood. The same appearance is produced by a sudden Passion of the Mind as in fainting wch debilitates the System, so that the blood is not driven to the extreme Vessels, & the colour soon becomes as the circulation is more or less forcible, and where the blood is exhausted, we explain the appearance from the Globules going into invisible parts, and being

being readsorbed, Thos They detain the Colour, May Red globules seem to enter the Absorbent vessels, more readily than the serum with which they abound, & hence the redness disappears while the Yellowness remains. And I have observed 20 or 30, or more times, That the Red parts of the blood are actually received by the Absorbent Lymph.c vessels and that, not only where there was an Extravasation, but where from irritating a part We produce Inflam.n upon Examining the contents of the Thoracic duct, wherein the Inflam.n is detected, We find That the Red particles have been received into the Lymphatic System. And so far I used to allledge many years ago, but till of late, Thos We were able to shew a fallacy in the

common

common system, yet We found some difficulty in substituting a better in its place, and We are chiefly indebted to M. Lavoisier for pointing out the way in 1789. And since that time great improvements have been made with respect to this subject, by a number of eminent Authors, particularly by the Abbe Fourcroy and by the late Mr Newton, Who has repeated Fourcroy's experiments, with considerable additions.

So We are to explain the principles of the blood in this Manner. We are to conceive it to consist of 3 or 4 distinct parts, or principles. Three of these We can shew to the Eye, and with these there is entangled a quantity of air, which is very readily disengaged from the blood. And in proof of this My Father long ago made the following

following experiment — We tied up
the Carotid Artery of a living Animal
in two places, & then cut out the
piece. We next threw the Artery wth
the blood into a Vessel of Water, from
which the air had been forced &
the Artery being heavier sunk to ye
bottom. We then put it under ye
Exhausted Receiver of an Air pump
and took off the pressure from ye
surface of the Water; & in consequence
of this the Artery rose from ye bottom,
i.e. By removing the pressure of the
External air, the air in the blood
had separated from it, extended the
Coats of the Artery, & rendered the
whole Specifically lighter than
Water, &c. The other parts are
1st An Aqueous liquor, with a
quantity of salt of a particular
kind dissolved in it, and which

fixes

Serves the Blood a Saltish taste, & this
Sense calls properly the Serum, We
may compare it to the Urine of
Animals, which it resembles very much.
2dly The Red, colour'd part, composed of
Particles, which for want of a better name
We call Globules, Till lately they were
Sens'd, Tho' not universally supposed
to be perfectly Spherical, and ye first
person Who by Glasses exper^t pointed
out the Contrary was Mr Abbe Terre'
We found That They were flatt, But
We supposed, That in the middle
There was a hole, But Dr. Nouth and
Mr Pierson have corrected ye mistake
and I have no manner of Doubt, but
That the middle is unimperforated &c,
Mr Pierson has compared the Red
Parts to Shillings, now They differ
very materially from these, and it
is

is difficult to describe them, May there are some circumstances in the shape that are not sufficiently attended to. I am not at all satisfied with the form, they appear to resemble a Magnifying Glass cut in a line, or Compassing its thickness with the Breadth, They resemble a thin Cheese, rather than a piece of Money, & the middle part seems to have properties different from the edges. When they are examined with a faint light, the middle appears darker, if with a strong light it collects the Rays, nearly as a lens would do, & appears particularly bright. The shape is by no means to be explained from any idea of an oily matter, or of a Speck on which the blood may be supposed to have acted within Readily the serum has

that to the red parts. But we are
yet very far from being able to
comprehend the manner in which
the red parts acquire that particular
figure. The red part is the heaviest
of the Mass, the undermost part of the
Clott being of the deepest colour, or
when we mix the red parts with
Water, it falls to the bottom, or the
Case is the same tho' we mix it
with Urine.

Next, You have observed in Jaundy
Diseases, that the Surface of the blood
tho' colourless, becomes very tough, and
is said to be sizey, or to have a
Buff coat, this may serve to give
the idea, that the Coagulation of
the blood may depend on a
different principle from the red part,
or that the red is not the Coagulable
part

part, or if We take it for granted
That the Size is a Natural part
We may Readily suppose That the
Coagulation may depend on it, Or
We may demonstrate That This
part, wch has been called the Coag=
=ulable Lymph, is the Coagulating
part of the blood. I have collected
it pure, from the Lymphtic vessels,
I got a Colourless matter which
coagd into a Clot; Or if You take a
Clot of blood, divide it into slices,
Wash it with Water & take away
Colour, the Coagulable lymph rem.
Or if We let the blood run into
Water, Agitate it wth a stick, The
Coagulum is found on the stick,
So the Clotting depends upon This
principle, and this owing to a
Great Measure to the Exposure to

the

the air, which has an effect of coagulating it in a remarkable manner, Tho' I have observ'd that on laying a vein of a living Animal in two glass, & wetting one with Spittle & hanging it perpendicular in both, Therefore the Contact of Air is not Necessary for Coagulation, but assists greatly. Thus I have tyed or cut the Thoracic duct, when a quantity of Lymph was effused in the Cavity of the Thorax, and Tho' it was 36 hours after, before the Animal died, yet upon opening the Thorax, the Lymph remained fluid, but upon being exposed to the air, it coagulated in a few minutes, which shows the great power which the air has in assisting Coagulation.

Next, You all know, that what we call the Serum of the blood, when

when exposed to a boiling heat Or
mixed with Acident Spirits Coagulates.
Hence it has been thought that the
Serum contains merely the Serosity
of Blood, with the Coag^ble Lymph.
But tho the matter that can be
Coagulated in the Serum, very much
resembles the Coag^ble Lymph, it is
Doubtfull if we are to consider it
as absolutely the same. For tho
We can prevent the Spontaneous
coag^n of the Lymph, by mixing
w^t it a Saline matter Resemb^g
the Serosity, But from Mr Hewson's
Exp^ts it is found that the Lymph
can be Coagulated by a smaller
degree of Heat than the Serum,
We can melt it down against
Water which We cannot do to
the Coagulable Lymph.

Serum

From what I have mentioned you will readily understand the appearances which are produced when blood is let out of the Body into a Vessel. As soon as it is at rest, & exposed to the air, the Lymph spontaneously begins to coagulate, while in the mean time the Red Globules by their greater weight are falling to the bottom of the Vessel, first slowly, and hence they are gently entangled with the Lymph. From one Orb. but in which it is very evident, there is more Lymph on the surface & more Globules at the bottom, in consequence of their greater weight, and hence the bottom is of a deeper colour, independent of the effect of the air, which too increases the redness of the blood, but even where

where it is not exposed. The circumstance
is constantly the darkest. Again, you
remember the power of air in
coagg the Lymph, in consequence
of wch the coagn begins at the
surface, & as the suppuration spreads
towards the under surface, where
a bony coat is formed, the suppuration
is the firmest, and it is often as
you go downwards. In the mean
time, by the coagn of the Lymph,
the large red globules are collected,
while the serosity is carried,
carrying along with it what of the
Lymph it is able to dissolve.
Or we may compare blood wch
is clotted to a process for clarifying
sugar, from any foreign salts.
We add the white of an egg
& by agitation mix it with

the

The whole mass, then exposing it
to a boiling heat, the white of the
egg curdles and collects ye fæculencies,
whilst the water & sugar are squeez'd
out producing an appearance like
to the colour of the blood.

When you know the component
parts of the blood, you can form an
idea of their use in life, The serosity
gives fluidity to the whole & preserves
the figure of the Red globules, from a
sort of repulsion which is between ye
two parts. For We dissolve the Red
part easily in Water, whilst ye
serosity they preserve their fluidity
much longer. Next, the Lymphatic
part gives a body to the whole, &
perhaps likewise by being interposed,
it more remarkably divides the red particles
and prevents their unnatural union,
as by the Mucilage of Gum Arabic

We

We separate oil, tho' the analogy is not so much. The lymph also prevents the exudation of the serosity into the several cavities of the body, as happens in the case of Dropsy, and on many occasions it is interposed by means of an exhalant between the different parts of the body, for the easy motion of one organ on another. Whilst the red globules give a momentum to the blood, and the difficulty with which they pass through the Capillary vessels may be a cause of the momentum of these, & may be the cause of effects, the nature & extent of which we do not perceive.

Hence too we understand some of the changes which take place in the bodies of animals both before and after Death. We have observed that

the

The spontaneous separation of blood
takes place, without the access of air
& hence you understand that where-
-ever a large part of the blood is with-
-in the course of circulation or stagnates,
it must be disposed to coagulate.
We have a proof of this in both kinds
of Aneurism (true & false) Where one
layer of the coagulum is gradually
added to another, & Nature makes
the feeble effort of continuing life by
stopping up the diseased artery in
this way. Next we find from
Masses in the Veins, or false
concretions, wh. may contain the
Rudiments of a fibrin covered wh.
the coagulable part of the blood.
And from these facts we must
allow that in certain cases
Polypi may form within the heart

and

and be the cause of much Disorder,
Tho' the Diseases assigned to this cause
generally depend upon some other
We may conceive that on certain
occasions the parts of the blood may
run together, as in fainting fitts, and
that upon the body being restored to
its vigour, the action of the heart may
undo the clott that is beginning to
form; but if the Person continues long
in this languid state & the powers
of life are not sufficient to separate
the parts, the Ground work of the
Polypus may be laid— Again if
any part be Wounded, tho many
vessels are divided, all but the
larger stop of themselves, besides by
Contraction of the Vessels, a coagulum
is produced by the Exposure to

the

the air, which plugs up the mouths of those Vessels. And lastly We can explain the appearance of Sizey blood, or Buffcoat, if it is only supposed that the blood is less disposed than usual to run together, so more time given to the Red Globules to fall to the bottom, in consequence of which We find the Lymphatic part more on the surface, tho from the difference in the colour there is reason to suppose, that in some cases the Morbid state may have taken place. ——

Lect. 5th

At our last meeting I began to give You some explanation of the Structure & Economy of the bodies, after endeavouring to distinguish the Animal from the Vegetable Kingdoms, I observed the Necessity of a New supply, and mentioned the means

means by which an Animal is
enabled to attain it, with the various
changes the Aliment must be supposed
to undergo, before it can ent. safely &
advantage be mixed into ye Constitution.

We then found That the Nourishment
is drawn in the way Vegetables take
up their nourishment by ye mouths
of Vessels, which from the Colour of
their contents have been called The
Lacteals That they join together and
form one Duct, or Tube, called The Thoracic
Duct, which terminates in a large
Vein near to the Heart, so that the
Nourishment is intimately blended with
the Red blood. And hence I endeavoured
from finding the Two mixed together,
to give such a notion of ye properties
and principles of the Mass of blood
as appears to me necessary in the
Physiology and Practice

As We know that every Minute
part of the body is undergoing a perpetual
change & Waste, & therefore needs a constant
Repair, We are led to perceive that from
the Veins where the Thoracic Duct ter-
=minates, there must be passages back
to every part. We observe therefore
that the Mass of Blood cannot be in
a Stagnating state, but that it pos-
=sess a continual motion. And We
are therefore next led to trace the
progress of the Blood in the body &
to examine the Causes on which ye
Motion depends.

When by dissection We lay open ye
veins at their termination in ye Thoracic
Duct, We are apt merely from seeing
them to be led into an erroneous
opinion as the Ancients were formerly,
for We find that from this place that the
Veins can be traced to all others, so
that We would be ready to imagine

that

that the blood mov'd from these to
all others; But on examining by Dissct
the texture of the Veins, We find within
them certain membranes wh. perform
the Office of Valves or Floodgates, readily
determining the Motion of the blood towds
the Heart, but hindering it from moving
in the Opposite direction. We May com=
=pare these Valves to a door wth two leaves
that open when you push it in one
direction, but shut when you push
it in the other. To this Observation We
may join what you have all had
occasion to Observe, that when A
Surgeon about to draw blood, throws
a Ligature around the arm, ye veins
swell beyond the Ligature. From
which you will be clearly
convinced that the blood moves
from the heart to all the different
parts of the body; So having ye Chyle
from

from the Thoracic duct to its termination
We find that it moves downwards to the
heart. Let us next examine the nature
of the Heart. It is evidently a Muscular
Fleshy Organ Capable of Contraction—
That the general shape of it may be under-
-stood, I shall show you it full wt wax,
and then the Flesh dryed. We find
joind with it a large vein called Vena
Cava & to distinguish it from anoth.
by wh the blood ascends from the
Inferior parts of the body it is named
Inferior. Where the two Vena Cavæ
meet together there is a large sinus
Sac, which stands out from ye Heart
especially at the point has the Shape
can of an Animal does from its head.
Hence named the Ear or Auricle
under the Auricle you observe a
very large sac which is called the
Belly, Ventricle, or Ventricle of ye heart.
Now in these cavities the blood
is

is squeezd as a fluid in a Bladder by
pressing it with the hand. Hence how
we can what direction the motion of the
blood is necessarily determined. The valves
in the veins prevent the blood from
passing backwards. Therefore when the
muscle squeezes it must pass into the
Ventricle. But when the Ventricle
draws itself together, where does the
blood go to? You now observe that
it cannot go back into the muscle,
for there is a Membrane placed
around the Mouth of the Ventricle
in a valve form its shape called Valva
Bicuspis, to me both for an outlet from
the Ventricle, is accordingly we find one
large enough to admit a persons thumb.
This passage leads to a round Cylindrical
shaped Vessel, named Artery but very
improperly, for it is borrowed from the
ancients supposition that such
Vessels

contain'd air. It might be expected that this Artery should be divided minutely, & dispers'd over the whole body and in fact in some few Animals as in the Frog it does so; but in the Human body this Animals resemble Man, in Quadrupeds & Birds, We find that the whole is spent on the Lungs and from thence is divided into two nearly equal Branches, one of which goes to each side of that organ, & when We proceed to trace it further, We find it plunges into the substance of the Lungs & is lost, still however We must continue to trace the progress of this Artery to every other part of the body as We have not found any other passage for it. We therefore attempt to pursue it just by the Eye perhaps; but We soon find that the Branches become invisible,

and

and Allegations can be our Notice. We must have therefore recourse to other Experiments, as the squirting of a ligature into the Artery & seeing what will become of it. So if we throw in a Milky ligature, we observe that the Colour is communicated to the whole surface of the lungs, & returning back again to the Heart, or that from the Artery it enters certain Veins called Pulmonary, following Rose veins, instead of sending them directly into Minute Branches, & that they lead to all the organs of our Body. We find that they unite & discharge the blood into a Sac which is similar to that already described, viz an Auricle. So to distinguish the two Anatomists from observing the situation of the heart in the Diaphragm have named the first

as

as being placed on Right side, The
Right Auricle, and the other the Left,
Tho in the Human body the Right is
more properly named Anterior, and
the Left the Posterior Auricle, but I
shall keep to the Common names of
Right & Left, so We find that a new
impulse was needed to drive the blood
with sufficient force to all the parts
of the body. And Now we repeat the
structure We have seen on the Right
side, or We observe that under the Left
Auricle there is a Ventricle, the Left,
and from this We see a passage leading
out from it, or an Artery taking its rise
which Anatomists name Aorta.
And You see that the two sides of
the Heart have no immediate Commun.
but are filled with Materials of a different
colour. And as a further proof that
the

The blood really take this course We
need observe that the blood when it
has got into the lungs by the Pulmonary
Artery cant return back again, for the
[illegible] At the Mouth of this Artery there
membranes which are so disposed as
to have the effect of shutting it when
they are pushed inward. They resemble
a Half Moon, so are named Semilunar;
& as the Mouth of the Aorta there is
exactly the same structure, We find
there three Membranes, which meet
together & shut the Mouth of the
Artery with the utmost accuracy.

We have found how the blood
passing thro the Heart to the Aorta
by means of wch it is dispersed thro
all the other organs of the body.
Now observe the Aorta makes a turn
or forms an arch, & from the top of the

arch

azel branches turn to the Head & Arms
while the principle trunk runs down
supplying the Thorax, Abdomen, & Lower
Extremities. In the horse we pursue
the Branches as I mentioned to be
necessary in the lungs, by Dissection
but in this way we can only go a
certain length, for the Branches are
soon so minutely divided that they
escape us. But by making an
injection as before w.th a coloured liquor
We find that it passes from the Aorta
into the Vena Cava, & that it gotts
back into the veins with the exam-
-ination of which we set out.

But as we are in danger of loosing
ourselves in so wide a field, let us
confine ourselves to a few parts of
this system. And first I shall show
you that the Arteries divide into

so

so many sacks & that these make such a bulk that if the Arteries alone are filled the shape of the part is in a great measure preserved, as in the Kidney; or to complete our Notion of the structure let us take one of ye Mamm^a bowels. So I shew you here that Membrane by which the Intestinal Canal is tied to the rest of the body and wch from its situation in the middle of the Intestines is called Mesentery When we follow the Arteries we find you perceive that instead of running directly to the Intestines, it describes a number of Circles & Neighbouring branches communicate with each other. Forming what is therefore called Anastomosis We observe the same thing continues in the still smaller branches of the Artery when joined together are larger than

than the Trunk of the former Horn, Or
you see a vast number of small branches
produced, which exceed very much in size
that of the Artery. When the Intestine
after injection are slit open and dried
you see the minute branches. When
the Injection is pushed a great way, the
communicate a Tour to the innermost
coat of the Intestine, and by a Glass we
can see an infinite number of very
minute vessels, which escape the View
of the Naked eye, and from a Microscope
we are obliged to employ in viewing
the Circulation it is very evident that
they must escape the Eye entirely; for
it is very certain that perhaps 100 or
200, of these Branches conveying the
red part of the blood in the extremities
of the Arteries do not equal in size
a single hair of the head. I therefore
repeat

repeat the proof I mentioned in speaking of the Pulmonary Artery that the blood passes from the Extremity of the Aorta into the beginning of the Vena Cava. I shew You an Injection made from the Temporal artery into the temporal vein, Or I shew You the veins of the hands filled by pouring Mercury into the Artery imitating the Circulation—

Next, You find that this motion of ye blood is constant & rapid. For the Heart is in Continual play emptying itself at every stroke of the Ventricle. So that if You enter into a Calculation, a prodigious quantity of blood is discharg'd Nay an Animal may be killed by opening a small branch of either System. And imitating an experiment made by *Lower* We can give another

proof

proof of the same thing. He transfused the blood of one Animal from an Artery into the Vein of another, whereby the first was drain'd of its blood, while the latter was enchanged, and by applying the Microscope We perceive it passing in a rapid stream, from ye extremities of the Arteries into the beginnings of the Veins.

Nod, When We attend more partly to the course of the blood in ye Human body We perceive that it moves twice too, & twice from the Heart, before ye full entire Circle is made, & that there is a necessity or use for the whole Mass passing thro' the lungs. At present I would be unwilling to dwell upon this, only it is certain We are constantly drawing and with the

the air we expire a poisonous matter, so if I breathe for a short time into a shut veſsel, & then put a small animal into it, it is kill'd; and I shall shew afterwds that we derive from ye air a somewhat neceſsy to Life.

6. The blood after going to the heart enters the lungs, & coming out from the lungs, again enters the heart, & we find that a new impulse is neceſsy in order to continue its motion. The force with wh the chyle is mov'd in the thoracic duct is not sufficient to convey it to the lungs, without the impulse of the heart, and far leſs can the blood be mov'd & diffused thro' the rest of the system without a new impulse. Such an organ is absolutely neceſsary to restore ye force

with

with what the blood circulates. For if
you fix a tube into the carotid artery of
an animal, as the horse, the blood
ascends to the height of 10 feet; but
on making the same experiment on
the corresponding vein it only rises 1
foot, so that 9/10 of the force is lost, and
therefore a new impulse is needed.
Or you observe that our heart is double,
that we have two hearts, one for circulating
the blood thro' the lungs, and the 2d
for carrying it thro' the rest of the body.

Let us now attend to the office of
each part. We find that four main
organs conspire to complete each circle,
a vein & artery, an auricle & ventricle.
The office of the vein, of the ventricle
& of the artery is very evident. The vein
conveys the chyle & blood towards the
heart,

Heart. The Artery carries the blood from
it, while the Ventricle gives the necessary
impulse, restores the force it was
lost, or renders our body an Automaton,
something beyond what we can imit-
-ate with Machinery. But it remains
that the office of the Auricle be ascertain-
ed and that is by no means evident, But
let us suppose it wanting, When the
Ventricle without the Auricle is in
action, What must have become of
the blood in the Veins? It must
have been accumulated in them,
whereby they would have been in
an Unnatural & unequal state of
distension. And when the Ventricle
had ceased acting, how was it to be
readily enough filled again? So
it seems as a necessarie of ye blood
circu-

seems it from the veins, whilst the
Ventricle is in action, & when ye Ventricle
has ceas'd from action it is ready to
fill it again quickly enough, and in
consequence of this to give it that
Stimulus or irritation, wch is essential
to the renewal of its action, for the
more suddenly it is fill'd, the more
it is solicited to react, and give
proper Jerk or force to the blood w^ch
it receives by it's ends to the Artery.

When the uses of the several parts
are known, We can determine the
Times at wch the several parts co-operate
some of them are Synchronous, Act
& are Relax'd at the same instant,
and that in the following order. No
matter what Supposition We adopt,
whether We mean to promote the
Circle into the Heart, and back
the

the action the Chyle would excite in every part, or that we suppose all ye Cavities full at the same time. We shall make the first supposition. That the Chyle gradually poured in, comes at length to fill the Auricle. When this is full and in danger of being burst it contracts, the valves prevent it from throwing the Chyle back into the Thoracic Duct, and must be thrown into the Ventricle, which receives it with an open Mouth. — Next the Ventricle is brought into action, & while it contracts it throws the blood into the Artery, in the Mean time more Chyle or blood is coming into the Auricle, so that it is again filled, & we observe that the Auricle & the Artery are filling at the same time, the

Artery

Artery from the Ventricle, the Auricle from
the Veins. As soon then as the Ventricle
again ceases from acting, the Auricle
empties itself into the Ventricle, whilst
the Artery is pushing forward its contents
into the Veins. So the Auricle and the
Artery are Synchronous, while the Ventricle
is in action they are filling, and while
they are in action, the ventricle is filling
and if you understand the manner
in which one side of the Heart acts, you
know both. & Let us suppose that
all the parts are moderately filled, that
they are all distended, & endeavouring
to contract. As the Ventricle is strongest
the contraction of it first takes place, &
as the two Ventricles receive blood from
each other, & have a common septum
they must act at the same time.

By

By their acting the Arteries are further distended, while at the same time the Auricles are filling and upon their ceasing from acting the Auricles which were before fill'd, and the Arteries wh were stretched empty themselves. So on every supposition the Auricles & Arteries correspond.

Now after knowing ye genl. structure & the times of action, we see why the Arteries possess a Pulsatory Motion, and why the veins want it. The blood is thrown into the Arteries suddenly; & tho' the whole arteries make a larger tube than the Aorta, the branches being when taken together much wider than a trunk, yet from ye resistance of the sides of the Arteries, of the angles which they form, & the immense mass of blood wh. is to be kept in motion

motion, as well as the quick action of y^e
Heart, the Tunicks of the Arteries receive a
a greater quantity of blood than they before
contained in consequence of wch they swell
and are made to change their place,
and hence the finger receives a stroke
from them. In the veins again the
blood runs on in an almost uniform
stream, for the stroke of the Heart is
insensible both before the blood reaches
the extremities of the Arteries, when it
is communicated to a large mass, and
disappears altogether in the beginning
of the veins. Just as when the thrown
blood into a sponge, by the delicate
pitts of a Syringe, there runs out in an
uninterrupted stream from ye opposite
side. And as the muscles and ye farther
end near to the heart is ready to
receive

become the blood, whilst the heart
is in action. There is no alternate
stop put to the return of the blood in
the veins, so it moves on in an almost
uniform manner.

With regard to the cause of this regular
action, the Discussion of the parts so little
known to act, but it would be improper
to enter on the full consideration of
this subject here. Nor are we to
consider the various uses of the Circulation
fully in this place.

You recollect what I explained of
the Nature of the blood, that it is disposed
to coagulate from a want of Motion, as
the Motion hinders it from Coagulation
And, the general Mass is no doubt
exposed to Putrifaction, and it is necessary
that the putrescent parts should
have

have an outlet, which is seven times
by the Motion communicated to the
blood, which presents it to the various
outlets of the body. Just as the Motion
of the Ocean by the tides gives room
to the discharge of its tributary parts.
You also understand the effect which
the circulation must have upon our
aliment. By certain processes it under=
=goes changes before it enters the Lacteals
and these changes are continued by
the repeated circulations, whereby it is
converted into blood. Next, you see
that as dependent of Respiration,
certain parts must be abraded from
the solids of the body, by the exertions
of the Heart, Action of the Muscles, it
also need an outlet, and by the
Mass being exposed by Glandular
organs

organs, the Discharge is more readily
made. And besides You may imagine
as the general circulation is capable of
converting the Nourishment into blood,
By certain organs of the body, whilst peculiar
changes may be operated; the Whole
Animal Oeconomy becomes altered when the
the Aliment wch is lodged in ye Stomach,
a certain time before it can be fitly
be adapted to the body, & it is previously
mixed wth the Bile & a variety of other
liquors, & by the circulation the Necessary
Separation of those liquors is promoted—
By the circulation too, the food is
expeditiously brot to every part of the
Body, to supply the constant waste,
which I shall prove is immediately
done by the Arteries, that these, and
Not the Nerves serve this purpose,

Read

Next. We may imagine that a loss of substance happens to the Solid as well as to the Fluid parts. by the exertions of the Heart & Vessels, as also in Wounds, so that new Vessels need to be produced, & a loss of ss to be repaired, wch with many other functions in the Economy are evidently connected with the Circulation

Lect. 6th.

At our meeting Yesterday I endeavoured to explain the Circulation of the blood. I spoke on purpose in the most General terms of the extremities of the Arteries. But if you now recollect what was mentioned of the principles of the blood, or its division into a red & colourless part, & compare with this the appearance of the body even when dead, when you find a variety of colours. In the skin for instance, in the white of the Eye, and in the clear

clear part of it, You surely must conclude that besides the Arteries which convey the red parts, called Globules, there must be others which admit only Serum, the Lymph of the blood, nay perhaps the water only; or that there are descending series of vessels, such as we ought to name Lymphatic, Serous, Aqueous; and you'll be the more convinced of this, when upon dissecting the body you shall find a still greater variety of Colour. Therefore. If I join my two hands together, suppose, to represent the connexion of an Artery with its corresponding Vein, the Thumb may be supposed to resemble a red Artery, whilst the other fingers represent the descending series.

Next, You surely must imagine that there are other besides the circulating extremities of the Arteries; You surely can suppose, that there must be arteries which separate certain parts from the circulating Mass; or that the whole do

not

not Return their Liquer to the Heart, For
without this How can the Mouth, or Eye
be moistened, & How do the small bowels
Play on each other, or the Bones, But by
an interposition of a Fluid? Besides Circul-
-ating Vessels, there must be Branches which
Anatomists in general call Secerning wch
Separate, or secrete certain portions. Thus
If I again join My hand & to represent the
Circulating vessels, suppose the Thumb &
three of the fingers to represent the Circul-
-ating Vessels, the little finger may be supposed
to represent a secerning one, Sunning a Fluid
into a Cavity, suppose of our joints. And in
proportion to the secretion made, This evident
there must be an Absorption, for without
this, one of two things must happen, That
either the several Cavities would become
Dropsical, the liquors coming at last to
Oppress them; Or suppose an Original
quantity Deposited, That, by Stagnateing
would Corrupt & erode the several parts.
It Remains therefore that We Determine
the

The manner in which the Circulating System begins, or how Absorption is performed.

But Here I must open to You a new Scene, You would conclude that the Lymph absorbing vessels which take in exhausted Fluids must terminate in Veins, & that they must be Veins. You can't imagine a Vessel performing Absorption to terminate in an Artery, at least not so readily. For the force with which the Fluids are driven in the Arteries is very considerable, but in the Veins the momentum is very much diminished, and the Fluids they contain are readily again returned to the heart.

The last necessary now to be explained is, that besides the Veins known to You all, which Run many of them under the Skin & appear blue Thro' it, which contain Red blood, There are very many in all parts of the body also another sett of Veins, To which Authors have given the name of Valvular Lymphatic, on acct of the great number of Valves or Floodgates with

with which they are crowded in their
course, & from their contents appearing
colourless like the Lymph of the blood.
They appear jointed, and at every joint
there is a pair of Valves. I shew you them
in the Lower extremity running upwards
from the foot along the Leg & thigh entering
the body at the top of the thigh & running
upwards till they join the Lacteal
Vessels to form the Thoracic Duct.

Now, whether are we to suppose
that the absorbed fluids are taken in
by small branches of Blood Veins, or
is this effect done by the ~~Lacteals~~ or
Lymphatics? & in what manner are
we to trace fluids from the Trunk of
an Artery back to the Heart. If you
look into the Systematic Writers, you will
find their notion to be this. They
suppose that from the Arteries are sent
off returning Branches, as well as Lacteals;
and that the Lacteal Branches at their
extremities divide into Coloured & Colourless
branches

branches, or Blood Vessels are Serous and Lymphatic arteries, which are so small so as not to admit the Globules and are therefore invisible to the Eye. But when we apply the Microscope to the Eye, looking at the Villous part of an Animal, We can distinctly see the ramifications of the Arteries, but none of the other branches, which escape us first, By their smallness, next, By their pellucidity and the homogeneous texture & appearance of their contents. So if you suppose a Glass tube is placed across this room and filled with Water which is pure, You cannot determine whether the Water is moving or not. But from the different colours of parts, that are as large as Globule enters the Clear part of the Eye, yet its progress & course proceeds in the same proportion as the rest of the body. We know that such Vessels exist in like manner in the Cartilages We cant discover the Vessels. Now so far We conclude with Certainty,

with

with respect to the division of the Arteries,
commended of late years, instead of such of
distinct branches, have imagined there was
only an Exudation from inorganic pores.
But you may take it for granted that
that the Arteries divides into Coloured & Colourless
branches, & that in like manner pursuing
Nerves the common opinion of Authors, these
are carried on to the Heart in this manner.
The red branches of the Arteries are supposed to
join the red veins, & the Coloured branches to
join the Serous & Lymphatic Colourless branches,
to join with the red Valv. Lymph.
Veins, whilst the different Liquors are
imagined to be emptied in by Branches
of the red veins, such as we describe in
the Arteries under the name of the
Exhalent branches, In the Veins they
suppose that there are corresponding
Inhalent branches, which by open mouths
take in the Colourless fluids, mix them
with

with the Colour'd, and that they both
Return together to the Heart, whilst the
colourless circulating parts Return to the
Heart by the Valv^e Lymphatic Veins.

Perhaps if I had not begun with an
explanation of the common opinion, You
might have made a better guess
than this will be found to be.
For tho' You had admitted that the red
Branches were the beginning of the Lymph^c
and end of the course of the Injected fluids
You would have more readily imagined
that these terminated in the Colourless
Veins rather than in the red for You
would have supposed that the Lymphatic
veins were provided not only with the
Circulating beginnings, but with Branches
performing Absorption. Like Reasons
tho' this supposition might not have
occured, We might have suspected
that while the one set of Veins, viz red,
performed the Circulation, the others alone
performed the Absorption. That the Branches

of

of the Arteries that perform Circulation, whether
Red or Colourless, from Red or Colourless beginnings
of a Corresponding Red Vein, whether Lymphatic
Vessels are unconnected with either the
Arteries or Veins, but begin by open mouths
every where. And I shall afterwards prove
in fact that this takes place, from a variety
of Experiments & Observations, from attending
to the Anatomy where the Lymphatics bear
to the Lacteals, and where you know begin
with open Mouths from the cavity of the
Alimentary Canal, from Attending to
their structure, to the number of Valves with
which they are every where provided, and
where these are wanting in a great measure
in the Beginnings of Red veins, or from Observing
their appearance in Living Animals, that
they continue to be filled after the Circulation
of the Blood has ceased, & from viewing
their colour & Observing their contents
corresponding with those that are extravasated
or secreted from the Arteries, from the
effect of Diseases & of Medicines upon them,
and

and more especially from Experiments of that nature which I have made on purpose. You will therefore at present rather take for granted, than be fully satisfied with ye proof, that while the Red veins perform the Circulation, the Lymphatic veins perform the Absorption, & that as an Artery in Red, & in Colourless branches, so the roots of Red veins are composed of these, whilst in the other system, the fluids move on as in the Lacteal vessels without the Impulse A Tergo."

Having now then seen that ye Arteries, besides circulating have secerning branches sent off from them, We return to the more particular consideration of these.

1st — We imagine that in many diff organs of the body, little more than a division of certain parts of the blood from others, may be necessary and this separation is made by what are called exhalent Arteries, in which, generally speaking tho' not

without

without exception, consid^{ble} changes are not made upon the blood, But when We reflect We are led further to see, that in many cases, a very consid^{ble} change of ye principles of the blood must be necessary. We surely do not find in the gen^{l} mass which I have described to You, a substance like Gall, nor can we easily from any of the known general principles, have an idea of the effect of the Semen in the Generation of Animals. We are surely disposed to imagine, what I shall afterwards prove, that the term employed for expressing this division made by the Artery viz. of Secerning Vessels, is only used for want of a better, and that a real Alt^{n} is produced. Or To show the probability of this still further, We surely admit that the Aliment we take in is, by ye repeat^{d} Circul^{n}, or by a certain process in pass^{g} thro' the gen^{l} System, converted into red blood; and from this consideration You will surely admit, that the General Mass

by

by certain organs of the body, may have further changes wrought upon it. Hence a complex structure becomes necessary, & we find large masses, which Anatomists call Glands, from their resemblance to an Acorn, in wch certain liquors are prepared & deposited. And we see another necessary circumstance, that several quantities of the same kind of liquor may be needed in one part. organ, or it may be necessary that a considble quantity shd be deposited in a certain part of the body, as the Urine, into the Vesica Urinaria, and the Bile into the Alimy Canal, for the preparation of the Chyle, and on both accounts viz. the changes necessy to be made, and the quantity of Liquor required for part. uses, we find a Convolution of Vessels, or a gland formed. I need not mention the Gen. names that are applied to the Glands from their

their shape, as long Bake when they are of a flobular shape, as those called Wax kernels, or which We find under the Skin in the Groin, whereas in other places a number of small globes or portions are needed, in order to supply a large Mass, when We apply the term of Conglomerate. From the Gland a tube is needed to convey the Liquors, & is called the Excretory Duct, and in these Ducts the small branches are constantly joining to form larger, or the Liquor flows as in a Vein.

The general structure being now supposed understood, We will next to form some notion of the principle purposes, which the Glands in the body may be supposed to serve. I apprehend it will not be necessary to enter into this enquiry very particularly at present — The Most general use of secretion that occurs, is the enabling us to perform our several motions

Readily

Readily, by preventing the Dryness and rigidity of the sevl parts, so we find Liquors thrown out for Lubrication. Next, as ye fluids of the body are in a contl state of change, not only the vessels but the Useful parts need an outlett, which is given by the glands. So while in a more evidt manner the urine is discharg'd, there is a contl discharge from the inner surface of the lungs, and the outer surface of the skin. Next, when you reflect on the preparation the food undergoes, & on the example of ye Oyster and Animal kingdom in general that however favourably they are situated for imbibing the Aliment, yet they take it into a Receptacle, you must imagine that by a glandular posture process, the food comes to be better prepared. We find a certain fluid matter separated, wch acts upon it as a Menstruum, whilst other

fluids

Fluids render it easier to be received.
and By the present section, the Nourishment
is ensured & applied to furnish the Substance
or Nutrition is performed by an Arterious
Operation — We shall afterwards find
that By means of secretion, the species
of Animals is continued, and a variety
of circumstances render it probable, tho
We are far from being certain of it, that
By means of this process the communion
is maintained between the living principle
of Animals and the body. & whatever
opinion We may form on this Head
it is evident, that an acquaintance with
this subject remains in order to
complete the notion we would form
of an Animal body.
We shall find that the communication
between the mind & body, depends upon
one particular Organ, and the subjects
which

which proceed from it, for You are aware
that the feeling Principle of Animals,
by wch We are rendd sensible of impressions
and enabled to perform Motions is not
Universally diffused: for if a limb is
amputated, tho' You wound the Members
the Person feels no pain; Nor can He, by
any exertion of His will produce the
smallest degree of Motion. So the
Principle is confined from what I shall
call the Sensorium Commune, a
somewhat residing in, or connected
with the Brain of the Animal.
I shall therefore more particularly
endeavour to point out somewhat
of the Structure of the Brain, and of the
Organs by means of which We are
enabled thro it to act. You all know
the General colour & appearance
of the Brain, When We attentively
consider

Consider its shape, We find another
portion of considerable size, wch is separated
by a deep furrow from a small under
portion. When an Anatomist means
Purpose to describe this part accurately,
He calls the upper Cerebrum, and the
under portion Cerebellum. From the
Brain & Cerebellum We find produced
certain cords of the same colour. There
is first, a very large one, protected by y^e
2 w^l bones of the back, named, Medulla
Spinalis. Besides this We find a number
of other cords passing thro' the Bones of
the Head, & from thence, down ye way where
ever are the w^l nerves of the body —
If We take any of them singly and
examine it, We find that it is composed
of fibres laid parallel to each other —
Now from the w^l nerves w^e proceed
from the end of ye Med^a Spinalis, and
which Authors call Cauda Equina,
because

because when they are split w.th a fine needle they resemble the Fans of a Ships sail. To these Nerves are the Fonts of the fibrous part of the Brain. When we trace the beginning of the Medulla we find it covered by a substance of an Ashy colour & named Cineritious, and over that there are certain Membranes to which very barbarous names have been given as Pia & Dura Mater, But the Dura Mater is rather to be considered as serving to line the Bone, and to defend the Brain, than as making an Essential coat to it. When we prosecute the Nerves from the Brain, we perceive the same Vascular membrane every where intimately connected with them. When the Nerve comes to pass thro' the head and to be dispersed to a more distant part, it receives the further addition of the Membrane called Dura Mater, and

hence

hence it appears a firm substance. But you are to imagine that the toughness depends chiefly on its outer coat, which is given it merely as a protection, for where we have it to the place where it performs its office, as in the case of the optic nerve, it lays aside its hard coat, & is soft and pulpy resembling the Medullary part of the brain from which it proceeds.

That Sense & Motion depend on the Nerves, I shall show in the most decisive manner. Why. By cutting any Nerve in its progress, as in the hind leg of a frog instantly the part below loses feeling We may afterwards cut, nay burn the toes of the Animal without its making any struggle to escape, and at the same time we destroy it of the Motion of the Muscles tho' the circulation continues & life, and live for a long time thereafter. I have kept frogs in this condition for

upwards

upwards of 12 Mos during which time
the insensibility & loss of motion continued.
to sense & Motion are the sole offices, wh
they in a summary manner are united
to Persons. for I shall prove that the
Nourishment is applied by the Arteries
of the Animal, not by the Nerves. —
When you view between ye Structure
you have seen, & made that the
Animal receives a supply equal to y^e
Waste that is made; and that ye Heart
and Brain of the Animal react upon
each other in a Circle, so that we are
at a loss to distinguish between Cause
& Effect; and that the Heart by its
Contractions restores to the Blood the
Momentum it had lost in its Circuit.
We are surely by reasoning merely
on the Structure, at a loss to find
a limited duration to the life of
animals; May merely from reasoning

We

We should conceive, that they were made to continue for ever, and We only learn the contrary from experience. But the limited duration gives a greater beauty & variety, by the diversity of the different Ages, and Animals are not seen disfigured by the inevitable ends of Being Live. The power of preserving all however would not have appd so great, as the power of limiting all ye kinds to a certain period. But from the accidents of life, and from what experience teaches, We see the necessity of ye power that Animals possess of generating their like. Over all the skin is drawn connected to the Muscles by a substance called Cellular, in order to prevent the too great evaporation of the fluids and to discharge what is hurtfull. By its sensibility it enables Animals to avoid danger, and in fine it is necessary to preserve the Machine

during

during its existance.

Thus Gentlemen I have given You, an Acct. of the Structure of the Body and of its economy as I thought Necessary before We entered with accuracy upon the Structure of the particular parts.

Lect. 7th Osteology.

The Bones serve for the defence of the soft organs in many instances, as in the Head, the Chest, the lower parts of the Trunk, and in all for their support & Attachment and hence a proper knowledge of these is evidently necessary for understanding the other parts of the subject.

In treating of the Bones I shall upon the whole follow as a Text book, the Treatise published many years ago by My Father, but with the liberty of deviating from him not only in my arrangement and method, but also in the conclusions drawn from the Structure, as often as may appear Necessary. If You look into that Work,

if you

you will find it divided into two parts.
The 1st treats of the Bones, or Basis in general,
The 2d of the Skeleton. By an explanation
of the bones in gen.l you'll find understood not
merely that of the Size and Structure, but all
the other parts connected with them, and that
the Texture, the properties, and Uses of each,
are accurately treated of. Now I apprehend
that it will be more consistant with the plan I
have laid down, To finish that before the
Anatomy of this part. Let us first
endeavour to know the shape, situation,
& connexion of every organ, then take its
Vessels, its Nerves, and conclude with the
Structure of the Bones. And hence after
we have treated of all the Softer organs
and as it were denudated the Basis, We
would examine it. I do not however mean
to insist on the absolute necessity of keeping
strictly to method in this part of enquiry.
Because, tho' in many other places it is so,
as in the examination of the Brain, of its
functions, of the lungs, of the Liver, &c. where

where we meet wth no obstruction from hearing the course of the Vessels, wch throws light on the manner in wch the functions are performed The Bones are supplied by Small Vessels and Nerves, from the Neighbouring parts. However when we mean to instruct Beginners at least, the order of that Treatise shd be in a great measure Reversed. For We cannot have a just notion of all the uses of the Cartilages, Ligaments, Glands &c in the Joints &c till the Structure and situation of the other parts be known, for by it we can alone assign the several Articulations. Therefore after mentioning in the most cursory manner the component parts of the Basis I shall begin with the Description of ye Skeleton.

The Hardness of Bones is found to depend upon the great quantity of Earth wch enters into their composition, for after a Bone has been many hours burnt in the fire, the parts retain their shape and it is in gen^l found, Not to have lost more than ⅓ of its Weight, tho' the proportion

of

of its constituent parts differs in different
places, from the different hardness of ye bones,
and it also differs in different Animals.

When We examine the texture of a bone,
We find it composed of plates, layers, or Lamellæ;
which are readily seen in bones that have
been long exposed to the Weather, Next, We
may prove that the Lamellæ are composed
of Fibres, We seem to see these when we look
at the thigh bone of an Adult, but We may
expect some deception, as the fibres of ye muscles
around the bone may have made prints
upon it. But when We examine the bones
forming, as in the skull bones of the Fœtus,
the fibrous structure is very evident. May
We come by proper and demonstrate ye fibres
in the most solid bones of the body,
by dissolving an Adult femur, We can render its
Fibres as evident as in a dried piece of
flesh. Next, When We cut a bone, whatever
be its shape, We find that it is Cavernous,
there is no entire Vacuity, a total want

of

of Vessels substance, but there is a number of Cells, or Cancelli; towards the extremities of the long bones, these are more numerous than at their middle, and in the same manner & proportion, the thickness of the solid sides diminishes. The sev.l Cancelli are filled with Marrow, which is not merely bounded by the Cavity made of the bone but is contained by a Membrane. So after a Bone is broken the Marrow can be shaked out of it in a Cylindrical form, even after it is boiled, and the heat sufficient to melt the oil; and it is divided into much more minute parts, than we.v at first sight suppose, and when we examine y.e Bones w.t very great accuracy We find that the Marrow passes between the sev.l layers.

Now, besides the advantages which We may derive from the Marrow deposited in the bones, there are very evident purposes served by their hollow structure. By this means the surface of the Bones is much enlarged, and the softer organs are

better

better fixed, and Ligaments of the Bones being greatly enlarged, We stand on a broader & more enlarged Basis; and in the case of the different accidents of Life, they are made stronger, they resist breaking more. Suppose the Bone squeezed into a solid, it is evident it will break easier by laying it across your Knee, than when it is hollow, and its diameter enlarged.

Next, in Examining a Fresh subject, We find the surface of the bone is covered by a Membrane, wch We therefore from its situation name Periosteum, generally the term of ectomem is added, because, many Authors instead of calling the Membrane in wch the Marrow is contained, The Membrane of the Marrow, call it, Intimum.

This Membrane adheres very closely to the surface of the bones, and seems connected to them in the recent subject, by a great many Threads, and many of these are truely Ligamentous & serve for its connexion, but many others are Vessels, into which an

an injection can be made easily to pass;
and in the manner We can inject that
membrane which contains the Mucous
and Vessels appear in it, even where great
pains are not taken to push the Injection.
I need scarcely obtain You with explaining
the uses of that substance, it serves to allow
the Vessels to divide upon it, and there are
many other purposes wch it certainly serves,
as well as some which it is supposed to
serve tho' with less certainty.

Next, Let us attend to the manner
in which the sevl pieces of the body are
connected. 1st We observe that the jagged
edges of one bone, may in certain places
make a Connexion wt the Neighbouring one,
as in the Bones of the Head, and this is by
Anatomists called a Suture, & there motion
is not intended, but some other purposes
wch I shall explain afterwards. Where
motion in some degree is intended but
where much motion wd be dangerous
as in the Spine, or where cavities are

joind

joind to our Breast bone, They are shied
together by a substance which approaches
to Bone in density but very much lighter
We do not find it Cavernous, and which
We call Cartilage. But if a free motion,
as in the Extremities of our body, be safe and
necessary instead of observing solid matter,
connecting our bones to each other, We find
that the ends are enclosd in a loose purse,
which We name from its use ligament;
and to allow the bones to play easily they
are first tipd with Cartilage, wch is covered
with a very smooth Membrane, and there
are substances like Masses of fat within ye
Joints, and We have a great many Vessels
entering them. The Fat serves for lubricating
the Joints, & its Vessels the Glands which
pour out the liquor which more immedy
serve for this purpose. This I apprehend
is all that is necessary for the preparing
us for the Examination of the Skeleton,
or the bones tied or joined together.

The

The Number of bones that Compose the Skeleton will be found greater than at first sight You would imagine, and that from what I hinted, that there were Sutures, or Sysoues between bones where no motion is intended. So the Head when the lower Jaw is taken away, looks as if it were one bone, But it consists of upwards of 20 Pieces. Next, almost every bone of the Adult originally consisted of different parts, which in the bones of subjects of 12 or 15 years of age, by steeping them in Water can be seperated again, so in the Thigh bone the round head is a part. The Explanation of this is, that the Ossification of the principle pieces begins in the middle and Nature, to hasten the Work, which would advance slowly from a single point, begins the Ossification in certain parts of the cartilage, which gradually extending till the ends meet, they run together with such force, as to unite, and the mark of the former division does not at all remain. Such pieces are generally named

named by Anatomists Epiphyses, or something growing on the ends of the bone; and these after they are join'd inseperably to the bone are call'd Apophyses or processes; so that the greater number of Apophyses have been only Epiphyses. The Fibres shoot nearly in Right Lines, & therefore when the Ossification is compleated they form an irregular Mass. The Epiphyses are united to the Bone, and all the parts are Ossified generally about fifteen Years of Age.

Next, You will attend to ye general shape of our bones, They are comm'y divided into Two Classes, the Long & Round, and the Flatt & Broad bones. But tho' it is in vain to attempt any accurate Division of this kind, yet it is worth while to observe that this one cannot comprehend all the pieces of bones in our Body; for many are of a Round & irregular shape, so we ought to add a Third Class, of Spherical shap'd bones, and to add the term irregular, as.

as they differ very much from a Real Sphere, and properly may be called Spherical irregulars.

Let us next attend to the situation of the pieces, there are many of these placed necessarily in various Directions, as in ye Extremities of the body; but when you attend to the middle column on w^h the Head, & the Back bone & lower extremities, you do not find that the several pieces are laid perpendicularly over each other, & that ye Machine is constructed as a Mason wd construct the fabric of a House, but there are many turns, the Top of the Spine is pushed backward, then it turns forward again, then there is a Deep hollow at ye back the Spine progeding backward, in that this portion forms an Oval.

The lower extremities are not placed immedy under the column, but at ye sides, nay, the bottom is not immediately under the Hip, but farther inwards, when we walk.

all

all which turns, serve to lodge and support ye
Necessary bowels, so the top of the Spine supports
the soft parts about the back part of ye Throat
& Mouth. The curvature in the Thorax prevents
the bowels there, from gravitating immediately
upon the hollow bowels within the Pelvis.
At the under part of the Trunk there are spaces
for the large Muscles, wch serve to Move the
lower extremities, & for the different cavities. And
as the Basis is enlarged, the thigh bone is
turn'd inwards, otherwise we must have
thrown our bodies from side to side, whereas
in consequence of this turn, we walk ye feet
near to each other & little motion is necessy.
But the attention to this circumstance leads
us to perceive the reason of a fact we all know,
that We cannot remain in any one posture
long, without being wearyed, as we are under
a Necessity of employing many of our
Muscles. Having observed these general
circumstances relative to the Skeleton, We
would proceed to make a proper division
of it into parts and to determine ye order
in which We are to consider it. The

Most

most common & obvious division is, Into the Head, Trunk, & extremities, and it is the best, We therefore begin with the Examination of the Head. It consists of the Brain case, or Cranium, and of the bones of the face or the two Jaws, The upper one is connected intimately with the Cranium without motion, The Cranium, in shape very much resembles an Egg with its small end turn'd forwards. You can explain the reason of this shape, because you have seen, That to the brain the Cerebellum at the back part is added and hence more room is necessary. But of just reason of the shape by no means appears. If We are to go further We will not say with Albinus, That the bones are disposed to shoot in a perpendicular manner which gives that shape, but that the Brain & Cerebellum serve as the Mold on which the bones form, or that the shape of these is such as you see, for reasons that We are entirely ignorant of. For the Brain and Cerebellum are form'd before the ossification begins, and the bone follows,

the

the shape of the Membrane, which forms the
Rudiments of the Brain.

Independent of the Advantages in ye exercise
of the functions belonging to ye Nervous System,
We see benefits from the Spherical figure, It
is not only more capacious, but it resists extern^l
accidents more; an Arch is every where formed
and the bones are not so easily broken. But
We can go further & perceive Advantages from the
Oblong figure, because the Face & back parts
are most exposed to injury. You all
know the difficulty of grasping together y^e
ends of an Egg, and to encrease this resis-
=tance the Cranium is lengthened out.
We also pass more easily among Bushes
without receiving injury. & more especially
We observe an Advantage when We
consider the situation of the Organs of
Hearing & of Sight. The Ethmoid can is
less exposed to injury by being shaped,
which Form makes a stronger im-
=pression upon the Organ, and the Sphere
of Vision is more extended, than if the

The Cranium has been brought into y^e perfect
sphere. The Natural shape, We Observe
may be chang'd very early in life, not only
by diseases, wch destroy the parts w^t violence,
as the Hydrocephalus, which greatly alters
the Shape of the Cranium, but by Habit
or any accident a change can be produced.
As if a Person when Young has a Very neck,
that side of the Head alters its shape, w^ch
shows that the Bones readily accomodate
themselves to their contents. Nay, Wealers
suspended that he could distinguish
different nations from Observing y^e shape
of the Skull, when there was less Com-
= munication between different Kingdoms, and
they were more attached to particular
customs. So the Head of a Turk is round,
from their folding it with the Turban, In
Germany from their laying Children to sleep
upon the occiput, that part is Broader
and Flatter, Whereas in England & y^e
Holland from their turning Children
from side to side, the Skull is of a more
Oblong shape.

After

After consid of the general shape, We would cut the Skull, to observe its structure, The Thickness varies in diff.t places, in general We find it thinner above than below, & that for two reasons. 1st is originaly so, because the upper part of the Cranium is less exposd. to injury, but the proportions vary with Years; for y.e muscles being necessarily placed below, and acting on one side, while the brain is gravitating on the other, the Base is continuually growing thinner, so that the difference of the proportion in old People is much varied

Next, Let us observe the Composition of it. If you look into Authors, you will find them describing it with much formality, as consisting of two tables, with what they call an intermediate Diploe, as if there was something very particular in its structure, but it agrees with every other bone of the body, as the Os Sacrum at the Bottom of the Trunk — We find, as I observed in describing the Bones in general, Cancelli in all of them, and the only thing perhaps

perhaps to be observed is, That the Cells are rather smaller here, than elsewhere, because the parts are more exposed to Injury, as the solid parts have not so much Matter spun from them for the formation of Cancelli, and in every other respect it has the common structure. If we carefully attend to the Thickness of the Tables, we shall find, What Authors universally describe, That the Os ethmoid is Thickest, & hence the name of Vitreous, or Glassy is given to the internal one: but the difference is by no means so great as has been commonly alledged, and indeed it is no more than we can readily account for — The Ossification from a Law of Nature, which we can not explain, begins in the middle of a small bone, and the fibres extend to all sides; Now it is evident, That the extent of the outer table must be greater than that of the inner because it describes a portion of a large circle, so the plates of the inner table are more crisped & wrinkled, & more compact and dense, besides the dissimilarity of the Matter

affects

affects the inner table, more than ye outter.
But we are by no means to found upon this
so much as has been done by many in
practice, as that where matter, whether from
Internal or External causes, has formed on
the Cancelli, it will of course, or at least
more readily fall in upon the Brain.
For tho' it may happen that such a matter
shall erode the inner table sooner than
the External, may that it may be more dis-
-posed to have this effect, yet in general
where a Suppuration forms there, it works
it way outward, as in the rest of the body.
But here the eroding is on the safe side, and
where we know a Suppuration that a
Suppuration is begun, we are carefully
to watch the consequences, and where we
know matter has formed from the Pulsation
and Dimensions appearance, we may
make an incision into the Integuments,
and then, where the symptoms are urgent,
we may proceed to take out a piece,

without

without any Material danger to the Patient,
even supposing We are in a Mistake, We
only avoid letting Air into the Brain in
perforating the inner membrane. Not that
the letting in the Air is so suddenly fatal
as some suppose, but it is best to
be avoided where it can be done. Neither
am We with Surgeons in supposing the
Operation of the Trepan, to follow the Rule
they have laid down, That We may not
be too very quickly till We find a certain
Degree of want of resistance, or till we come
to the Cancelli, where we are to go on more
slowly, because it often happens, particularly
in Young People, That we scarcely can see
the Distinction between the Table, & therefore
in every case We cannot determine from
the Want of resistance, from the Presence
of sound, or from the Blood Issueing, when
We come to the Diploe, so we are to
proceed with the greatest caution in this
Operation, supposing the Thickness of the
Skull

skull uniform throughout. But when we compare a number of subjects together, we find that besides the utmost difference in the general thickness, even of persons of the same age, & still more in persons of different years. In some there is a remarkable difference of thickness in particular places, & where we cannot well depend upon the Cranial. I shall see some skulls we have in several parts Diaphanous, tho' there is no mark of erosion, but merely that certain parts of the Brain have grown luxuriantly, in consequence perhaps of a certain distribution of vessels, but the fact is material to be known, otherwise we might cut both tables, & get into the brain, before we imagined we had cut thro' the Diploe. We observe in other subjects, pitts in particular places, not are remarkably transparent, owing to the meeting of a large number of veinous branches into a trunk. In some few cases I have observed this to depend upon a spongy flesh

growing

growing between the bone & the Membrane, or Dura Mater which lines the bone. The Trunks of the Vessels run upon the outer side of this Membrane, and whilst it is supplied with Vessels, the bone also is, and from a number of these branches forming Trunks Pitts come to be form'd. In other cases where there are marks of disease, or at least where it is probable there has been disease, we find a prodigious difference of thickness in diff.t places. I begin wt. shewing you a very great curiosity of its kind; Part of the Skull of a Ricketty person, upwards of an Inch in thick.s and where the outr. Lamellæ seem to have been seperated, so that there is scarcely any Distinction between the inner Lamellæ and Diploe, but the Density appears uniform throughout. There is another Skull, which seems to have been in a diseas'd state — In some parts it is remarkably thick, and in others as remarkably thin, and that in a most unequal way, it is exceedgy light

I

I shall now give another of a Person, who laboured under the Spina Ventosa, or Exostosis of the bones, and where matter was seen collected in the Cancelli, and where the matter had made its way thro' the outer, not the inner table, in several places, tho in other parts it had also perforated the inner. Now as this disease had not gone its utmost length we may suppose that these three Patients when the tables are separated, shall continue much thicker than the neighbouring; for when those parts are filled up by the Granulating flesh, the neighbouring parts, will be deprived of their proper degree of Nourishment. These excrescencies the Brains absorbs & carry it off. So in performing any Surgical operation upon the Skull We are to attend to the age of the Patient, his Constitution, to the accidents & diseases to wch he may have been subject. So far We would observe upon considering the general Structure of the Skull, & it appearance of its tables.

Next,

Next You will remark the surface. The outer surface of the Cranium at the upper part is almost smooth every where, because except at the sides of the head where the Temporal Muscles are placed, there is hardly any organ of such strength as can affect it. But below we find it very unequal partly owing to its connexion with the Bones of the Face, partly to the Attachment and Effect which the Muscles have upon it, and it is especially made unequal to allow & to keep the Effect of the Muscles, so it appears every where rough.

When We examine the inner side We find upon the same part inequalities not only certain bones being such, but a great many prints made upon the bones which are less evident on the upper portions. This is a proof of the Effect the Brain has in sinking deeper into the bones, for this difference is constantly increasing by years.

We

We observe certain Sinuses, made by large
Venous Vessels, but besides these We perceive
a Spirit made every where by branches which
resemble those of a Tree, and we have produced
by the Arteries which run on the outside
of the Dura Mater. We see the common
appearance of these in a Person of Middle
age, but in very old subjects they become
much more remarkable and if a Skull
happens to be fractured, the Crack readily
follows one of the Sinuses. Now whether
are We with Albinus to say, That the bone
has an inclination to grow round the
Vessels, or That the Vessels by their stroke
& swelling force their way into the bone.
That this is the case is evident, since they
encrease by age, when they always become
deeper in the Basis of the Skull. But
when We are considering the General
Animal, We are not merely to suppose
That the bone is more contracted, but
there is a continual change operating. The
Earth

earth is taken out, & again supplied, so there is a great quantity of the earthy matter carried off, from the bones of old People and at the same time preserve them from putrefaction.

Lect. 8th.

Having seen and considered the general structure of the Cranium, we now proceed to examine the parts or pieces which compose it. We shall find that there are Eight large pieces constantly to be found in adult subjects; and in many we also find small irregular pieces called Ossa Triquetra in the Interstices. The Bones of the fore part of the Head is from its situation called Os Frontis, further back we find two pieces which makes the sides or Walls of the head named therefore Ossa Parietalia. The hind part of the head like the fore is composed of a single bone, the Occiput, or Occipital bone; Down from the Parietal bones, and

and connected with the Cheek bones, the
five and two small irregular shaped pieces
named from their situation Temporal
Bones. Two still remain placed in the
under part of the head. The first is called
the Sphenoid Bone, because it seems to
resemble a Wedge, Broad above, and narrow
below. Some have called it the Alisfarm, as the
sides look like wings. The remaining
piece is perforated by many branches of
a Nerve, having a number of small holes
like a Sieve, and therefore named the
Ethmoid or Cribriform Bone.
In course of the situation of these bones
we are led of course to consider the several
Sutures. Anatomists have a very absurd
way of saying that these join the
Bones, they certainly on the contrary
separate them. We trace one Suture
between the Frontal bone & Parietal
Bones, which being near to the place
where the Ancients were their Coronal

is

is Generally named The Coronal Suture;
in The Back part of The Head You find
The Occipital bone joind in a similar way
to The Back part of The Parietal bones.
But The figure of This suture is not so
circular as The other, for we see a point
or Angle at The middle. So from its resem-
-blance our Letter V inverted, or a Greek Lambda,
it is called Lambdoidal Suture. Some
apply This term to The division between
The Occipital & Parietal bones only, calling
The remainder on each side, between ye
Occipital & Temporal bones, The additamenta
of The Suture, but we may comprehend
all under one name. The Suture between
The Two Parietal bones again being so placed
between The middle of The Coronal and
Lamboid sutures, as an Arrow is fixed
in The String of a bow Has been called
The Sagittal Suture. These three sutures
are all formed like The teeth of a saw
but at The side of The Head, We find
The

the Temporal bones lying over the Parietal as one scale of a fish over another, or as Tyles are laid on a Roof, & hence this suture is named Squamous or Scaley. It remains still, to shew the Sejsures between the Sphenoid & Ethmoid Bones. The Sphenoid Bone is connected to all the Bones of the Head, so Anatomists have been at a loss to confine names to all the Sejsures, and call them in general the Sphenoidal Suture, The last Bone the Ethmoid only fills up a very small part of the Cranium, and is supported by the Neighbouring bones by what is called the Ethmoidal suture,

Before We go any further We would wish to have explained to us the reason why the Cranium consists of so many pieces seeing that in the most perfect state the Sejsures remain and yet there is no motion intended. Now to explain this You must recollect, that the soft bones

bones, more especially the flatt ones, begin their Ossification in certain points, & that Bones in general are composed of Fibres which gradually shoot from centrical points, That there is no gradual hardening w^h^ originally enclosed the Brain, but that it begins to change into bone at certain points. Now We take that as a law of nature, that it is best, because We find it so; and it ocurrs that this being the case the whole fabric is soones completed. But neat, as a Spherical figure is intended & in some cases with irregularities That figure is more accurately formed by a number of Ossifications than by a few; as the more You encrease the number of sides of the figure, the nearer You approach to a Circle, as in the case of this Room, which consisting of eight sides approaches nearer to a Circle than if it only consisted of four. The fibres are directed from the first point of Ossification nearly in straight

straight lines, or come out like rays from
the Centre of a Circle. Therefore they scatter
as they proceed, so that the further you
go from the first point, the Bones are
constantly turning thinner and weaker.
and in fact I find upon trial, that the
middle of every one of the bones of the
Cranium is more dense, more solid than
the edges, so the greater the Number of
pieces are, the more the spreading of the
fibres is prevented, and the more equable
the strength of the whole becomes. Add
to this another fact, that in proportion
as the parts of our body grow harder
the growth of them is the slower, and
more especially the growth of the bones
is slower than that of the soft parts.
Thus with regard to the Teeth, a certain
number of them are changed, as from
their greater hardness they do not grow in
the same proportion, and it is easier
to change the first set than to enlarge
it.

it. We may easily apply this to ye Brain and the bones covering it. Besides unless Interstices had been left, so that ye pieces might have been pressed asunder by the growth of the Brain, that organ is to have been cramped in its growth, and if the Brains case had been one solid bone it could not have allowed the Brain to extend sufficiently. And as a last use I will allege that a number of pieces are found on purpose that the Birth of a Child might be rendered easier. And Accoucheurs all know that the shape of the head in time of labour is very much changed, and the danger lessened both to Mother & Child. And these I apprehend are the chief if not ye only humane purposes where the number of pieces can be said to serve, But there are secondary ends which will merit our attention.

I

I. Fractures do not extend so far as they otherwise would have done, the extent of a fracture is interrupted in a great measure by the first Suture it meets with. Not that in the most complete state of the body in the full growth where the bones press strongly against each other, its course is absolutely interrupted when the blow is very violent, but it is at least prevented from going so far as it otherwise would. I have got in my hand a skull that proves both circumstances, the person was killed when in liquor by a fall of about 10 feet into a vault, & the head seems to have struck upon some pointed substance, for a piece of the bone was quite loose; from that place the fracture extends across the Lambdoid suture, which did not prevent its extending, but you see it terminates exactly at the 2d suture. Now it is probable that without the intervention of this suture, the fracture would

would have gone further.

This observation leads us next to show some facts with regard to the change which the sutures undergo by age, and first, it is material to observe to you, that the sutures are constantly better seen upon the outer side of the skull, than upon the inner, because as I have hinted, the ossification begins in the middle of the bone and extends from that equally on both the tables, so that the fibres meet sooner when they are closer together, and there is not room for the dilatation, so they are pressed flat and turned outwards into the diploe, where there is less resistance.

The bones too are constantly drawing closer & closer together, & the external layer has some effect in this. For all the parts of our body by age shrink, and the moist parts shrink most, by the dissipation of their humidity so the brains shrink & more than the bone, the external air comes to act with greater force,

But

But the fact is, that the sutures in Early People are obliterated, and as you would suppose they first disappear on the inner side where the bones press against each other closely, and from this circumstance a fracture may extend farther on the inside than externally. In the Memoirs of the French Academy of Surgery there is an instance of that kind. The fracture was treated in the common way, but after the death of the patient it was discovered to extend further on the inner table than on the outer, and a splinter hanging from it seemed to have hastened the patients death — and this will more readily happen in Early persons where while the inner table is one continued lamella, there is a greater thinness of the bones.

Another reason why use of the sutures is, that in Children the Dura Mater is better supported, the membranes join with the Internal & are closely connected by fibres many of which are ligaments while

others

there are vessels. Not that such a supposition in the intestines of the Bones is so very necessary as many Anatomists & Surgeons have supposed from their not considering that the Dura Mater is intimately connected to the bones by vessels, that it is in fact the External Periosteum of the inner Table But we may observe on this greater connexion, that the first admits of some application in practice, that in reality there is more vessels, & those larger near the sutures than elsewhere, and hence Chirs sparibus in Diseases of the Head, there may be more advantage from cupping or applying blisters, or forming issues near to the sutures, than over the middle & more solid parts of the bone where the communication with the parts within is less free.

Lastly, I wd observe that the number of pieces allows the Cranium not only to alter its shape in the time of delivery, but afterwards

afterwards from various causes, that ye bones
yielding the brain may be extended with
out injury, as in the Hydrocephalus, where I
have seen a considerable quantity of water
accumulated within the Ventricles, which is
not unfrequently remarked by Dr Whyte. In
a subject of 3 years old I found 32 Ounces
and in another of 9 years near 3 Pounds. The
Disease generaly proves fatal before many
ounces are collected; and in these cases if
the bones had not yielded the Disease would
sooner have proved fatal, and in other
Diseases where there may be also an in=
=crease of bulk, the yielding of the Bones
in Young Children may have good effects.
In certain cases were the Cranium consisted
of one bone, the Disease would have proved
fatal, whereas by yielding the Patient Recovers.
Many in the first book I shall send some
Authors quoted, who have Described some
cases of Adults in whom the Sutures
were open'd, tho' because the Patient
Revived, the cause was not well known.

We

We have an instance of this case by Doctor Simson of St Andrews, & another by Mr Pitt Surgeon in Dumfries, and I was informd of another last Winter by a Gentleman who attended there. In them all, the Surgeon could place the finger between the bones, yet again they all consolidated. In that seen by Dr Simson, the suspecting Water made a Drain, and a more than ordinary quantity of Water came away for several months, & at the end of 6 the Patient was cured & relieved. Therefore tho' some are killed by Water collected on the Head, without its opening the Sutures, yet in other cases the force is sufficient to open them, and the Patient survives.

So far We observe of the constant pieces which compose the Cranium, but there are small bones found on ye underside of the larger ones, & they are called Ossa Triquetra, Now these in general are to be observed in the Lambdoid suture without

without our being well able to Assign any
Reason for it, but we do Suppose it to be a Fact,
and they are sometimes of a very great
size, as large generally as a Crown Piece.
We sometimes however find them in the
other Sutures as well as in the Lambdoid as
in the Sagittal where it meets with the
Coronal, but these we are to consider very
much as Lusus Naturæ, which we can't
clearly account for, for we find them in the
Heads of Persons who never laboured under
any Disease of the Cranium. In some
cases they are produced in another way,
they are found in the Hydrocephales, where
the bones have been consideably distended
and Separated, when small bits have
begun to form in the membranes between,
Nature attempting to fill up the void.
The Knowledge of them to a Surgeon is
evidently useful, that he may not
run into a mistake, like to that into
which the Hydrocephales ran, of supposing
a

a Natural suture to be a fracture, The distinction is evident, The former runs in a straight line is not serrated, and is very different from the latter suture, The edges of which is smooth, and on the same level with the rest of the bones; the fractured piece too is sometimes moveable tho not always. but these two circumstances being join'd together, there can be but little danger of falling into a mistake — Having now shown & explained the general structure of the Head, I shall proceed to demonstrate the particular pieces beginning with the Os Frontis. As this Bone is much exposed we find it remarkably thick, dense, hard, & strong. Nature discovers a small arch than the others which considerably increases its strength. The whole part of it, so far as it is exposed, is smooth, as it is only covered by a thin Muscular organ, which seems to be rather calculated to smooth the bone than to make any impression on it. Within, it is smooth as the outer part,

as

as the lobes of the Brain do not bear much upon it in the next posture in wch the sides of this part is more marked, as ye lowermost part of it is in the Human body. In ye middle we observe a ridge at the bottom, and above there is a furrow. Now to explain this you will observe, that in a Child this bone consists of two pieces, and when these come to press against each other, they do so very subtly as Nature intends to unite them, and the lobes are readily turned inwards & what they meet with the least resistance, i.e. between the two great lobes of the Brain, in this manner we account for the ridge, which serves to give additional strength, and a more convenient connexion for what is called the falx, from its resembling a scythe and the furrow above is occasioned by a large vein, wch is included within the falx, in a doubling of the Dura mater. One conclusion we would draw from knowing the situation of that ridge, and ye furrow above,

above, is that we would avoid applying
the Trepan in the very middle of the bone
as much as possible, where a bit of bone
was beat in upon the sinus, I have caused
the Trepan to be placed immediately over
it, but we would avoid this if we had a
choice, for a neighbouring part will serve
the purpose, but where we are under
the necessity of operating upon the middle
we must proceed very slowly, whereby we
are in less danger of cutting the tough membane,
which yields before the instrument. At the
under part of this bone we found two ridges
on which our eye brows are placed, and
therefore named the superciliary ridges, and
they project very considerably, especially
at the outer side, where there is a deep
cavity formed, within which the gland by
which we separate the tears are placed &
the ridge in order to protect the ball
of the eye. Descends a considerable way,
so if it is necessary in order to discharge
matter

matter from the Cranium to make an opening there, we would avoid the lower part of this bone, otherwise the may enter the eye, I had an instance of this kind come to me where a Person had this bone broke by a fall, and to the Surprize of some of the Surgeons there was no opening into the Cranium, so that the opening should be made the breadth of the finger above the edge of the Superciliary Ridge. The Orbitar plate is generaly thin, partly in old persons so there may Danger from sharp pointed instruments thrust into the Orbit, they there are examples where by a shot in the eye the Person has Died, the Concussion being communicated from the bone to the brain. The artery which supplies the Ball of the eye, and Runs on the Dura Mater is not come from the External Carotid, according to Winslow, but from the Internal so that this is one of the few mistakes in point of fact which he has committed. As the eye is supplied, branches come out

out on the fore head, making the Frontal Artery attended with consid^{ble} Nerves, the artery comes out from a notch in the supercilliary Ridge and in many subjects there is also a hole, an ingenious gentleman Dr Blair has proposed the opening of this Artery in fevers affecting the head, He was probaly led to this from an observation in Hippocrates; that when the blood has been discharged from the Nose in such cases, it has prov'd the Crisis of the disorder, and He may also have gone into the Mistake of Winslow that the branches were derived immediately from the External Carotid, Now tho the proposal seems very probable, yet I affirm it is by no means to be rely'd on in Practice; For it is greatly to be doubted whether the few drops of blood from ye Nose, prov'd a Crisis of the fever, tis more probable that by the struggle of Nature about the Crisis, a few drops of blood may be discharged, and that it

was

was more Effect than the cause of ye evil.
Besides the Drawing of the blood from that
artery is highly Dangerous on account of y^e
nerves that accompany it, and the operation
is not less difficult, as we are not able to
distinguish the stroke with the finger, and
the Notch (hole) vary in different persons,
and for the most part the artery is not bigger
than a stocking wire. So it is better to let
the blood from the Temporal artery, where
operation is more Effectual, and more easily
done. In the Frontal bone there are
certain Cavernes or Sinuses, placed above
the root of the Nose, & from its being composed
at first of two original pieces, we find a
Partition between them, and ye Cavities
on each side, & Pores if ever communicate.
In a Child at birth there is only a sort
of Spongyness & Thickness of the Bone, but
there is not room for any considerable Cavity.
By degrees they enlarge greatly in some
persons, & we can generaly judge of the
age

Dige from looking at the forehead; which is much flatter in some than in others: sometimes the enlargement is unequal, greater on the one side than on the other; sometimes they exhibit the whole breadth almost of the Bulbar processes, and we find in each of them unequal partitions; & we shall afterwards find they communicate with the Nose, at present I avoid entirely saying any thing further of these masses than what respects their general place. For we can't judge of their use till we have seen the whole structure of the Nose, of which they form a part, Only with regard to the application of the Hepars, we surely would avoid applying it here, because of the difficulty in the first place, with wh the instrument might be made to penetrate the two spheres, wh have a different direction. Next, We must take into account the degree of danger that may follow from the wound of

the

the Sinuses, the inflam^{n} that may take
place. This has been exaggerated, tho' We
must allow that the membranes lining
them are very sensible. The matter
discharged from the brain, not getting out
would corrupt & occasion Caries, wch might
be communicated to the Brain itself, and
from thence also communicating with the
Nostrils, we would give free access to the
air, which we know to be best suited in
such cases. Nevertheless they are
seldom to be forced to, Surgeons ought to avoid
this place. However I shall give you a case
where I prevailed on the Surgeon to do
the operation here, & to take away a
great part of one of these Sinuses, & also
a part of the plate wch seperates the
Brain from the Eye, the bone was
loose, and the shash point raised
upwards, but unless in such a
particular case, where mean to give
a discharge, we place the instrument
higher.

higher. Another remark remains, that as the os frontis is originally composed of two pieces, it will frequently happen, that these will not be accurately united, & hence we will find the sagittal suture continued to ye nose, and it is alledged that such a division is more frequent in Women than in Men, as ye ossification in them does not proceed wth the same degree of force.

Lect. 9th

We next proceed to examine the Parietal Bones. Under ye sagittal suture we find the continuation of the foramen mentioned when describing ye last bone, and as the large venous canal, which following the Ancients we call Sinus, is continued here. The remarks we made with regard to the Os Frontis also applies here, In most subjects we find branches chiefly of the vein, & not of ye artery of

of Reinnes side as some have alledged communicating with the branches from the Veins on the better side, and this shows ye evident comm^n between the External and Internal veins. But in wounds this has no considerable effect, as a slight pressure stops those vessels. But Nature intends this comm^n. So that the great veins leading out of the head, the internal Jugulars are stopped, the blood can return in great quantity getting by means of this comm^n into ye External veins.

The Connection of these bones with the Frontal is very curious, & not sufficiently attended to by Authors, for in the middle where from the length of the Os Frontis and its flatness, it is in danger of being beat in, it takes advantage of the arch form'd by the Parietal, & rests upon it, but at the sides, where the Frontal bone is not in danger of being beat in, the Parietal is from the flatness of ye head,

&c

The Parietal bones at their corners, are laid over the Frontal.

In the Child at the full time, these two bones, and the two pieces wh. originally compos'd the Frontal bone, are imperfect. Or you perceive a part of the head, which instead of being compos'd of bone, is made of Membrane, quite transparent, & where the Dural Processus, or Processus adhæres by threads & fibres to the Dura Mater. From the softness of this part, you can feel in a child, the motion of the brain and there are two kinds of motion which we can distinguish. The first is of the beating of the Arteries of the Brain, that however is more or less distinct according as the large branches of the Arteries upon the surface of the brain happen to be situate. But the chief motion is a gen.l swelling and subsiding, & wh. is connected with & depends upon the state of respiration. When we expand our lungs to inspire fully

fully, the several branches of the Vessels have not only more room to let the blood pass, but they are drawn, by the stretching in of the air, more to straight lines, and hence the blood passes more readily thro them. In every expiration, and in that space of time which intervenes between an Expiration and a New inspiration, the blood passes through the lungs with more difficulty, hence it is accumulated in the veins, in so much as it makes a great heaving at this part, and as the Brain is confined in every other part, almost the whole dwelling is felt here, so it is named the Vena Pulsatilis. I am the more particular in describing this motion, because a want of attending to it has led several of the Modern Physicians to lay down a very dangerous Rule. That by applying the finger here the Physician can distinguish whether a Child be alive or not. But little or no regard is to be paid to this mark, for besides the compression of the parts, there is a considerable thickening of the

Arguments

segments, & it is only after those have grown thinner, that we are able to distinguish the stroke of the Artery, and with regard to the heaving, which is the chief motion, it is not then begun, as it depends on the state of the respiration, and the child has not yet drawn in the air, and but a small portion of ye blood passes thro' the lungs. So we are to determine the state of the child from other marks, as by the nervous state of the Mother, whether the child's motion has been felt before, from the Falling of the Waters, the dilatation of the orifice, or if you judge at all from y^e pulse no You attend to the strokes in the Umbilical chord, or of the artery in the Leg or arm.

From this imperfection of the head, We are led to other Cautions, as the Bones some= =times in difficult labours overlap each other, and the pressure is very considerable We may suppose a Case, tho' I have never met with an instance of it, where the Brain itself will be pushed out, & form a Hernia, or

Thost

that it may form such a tumour as is not unfrequently seen upon the heads of Children but which is almost always owing to blood or Humours under the skin, & at any rate Incisions are by no means so often necessary as Smellie seems to recommend.

Another remark is this, You have heard me mention Hydrocephalus, or Dropsy within the head, and that the Water is sometimes so collected as to seperate the different peices of the Cranium, & that in Adults as well as in Children, tho' most commonly in ye last. Now tho' the Water be generally collected perhaps in 99 Cases of 100 within ye substance of the Brain; yet we would suppose, and it is certain in fact that it sometimes collects between the Dura & Pia Mater, and in such a Case we might give the Patient a better chance of Recovery by making a puncture and Discharging the Water, So suppose a Case to present where there is a seperation of the bones & a general Distension, We are not absolutely certain that the Water is within

the

the brain, when it is perhaps external, and
indeed in this case we might expect that the
pulsation would be better felt but if the brain
by being distended is made thin, a degree
of pulsation may be discovered thro' its
substance. We may satisfy ourselves of this
by an experiment. Make an opening into
the brain and a slight scratch with a lancet
will be sufficient — I attended a case
of this kind with Dr Grant, & where this
very operation was done, We caused an
incision to be made of half an inch long
thro' the skin, then the surgeon was directed
to make an opening with caution at one
side of the Bregma, carefully avoiding the
middle of it on account of the superior
longitudinal sinus; and as the water did not
burst out on cutting the Dura Mater, We
made him desist. The child died not
long after, & We found the water collected
within the brain. we must examine the
occipital Bone. About 18 or 20 years
of

of age, We find the Occipital & Sphenoid Bones
devided by a Cartilage, but soon after this they
grow firmly together. We see the reason of
this union, for a Suture would have been
here unsafe. as the Weight of the Head rests
here upon the top of the Spine, and if the
Bone had been thin, or a Suture interposed
and a Person carrying a load had fallen
by the load pressing against the top of the
Spine, this part of the bone might yield.
and we are told of a Porter at London who
was Kill'd in this way, falling with a
Burden, the Process which connects ye Occipital
bone to the Spine was much depressed
and it was supposed to have wounded y^e
substance of the Brain itself—

It is alledged in some Anatomical books
that the Sup^r Suture is sometimes continued
down as far as the Foramen Magnum, But
I suspect that this notion has arisen
from a false and hasty, & without attentive
observation. We find it continued down

&c

to the nose, because the Frontal bone was orginaly two pieces, but this plate of the Occipital bone is all one piece, so there is no reason to suppose that this is ever so. If there is any thing in the Observation at all, the mistake may have been owing to Two large Ossa Triquetra, which may have gone down a certain way.

Now after You have seen this structure of the Occipital Bone, You will readily agree with a Genl. Rule laid down by Surgeons, That where we have the choice of ye place We ought to avoid applying the Trepan to it, speaking in general, because of ye inequality in its thickness, the Surgeon meets with ridges, or one side will be cut thro' before the other; & besides the ridges We meet with furrows to a considerable depth which are made by the Superior Longitudinal, & Lateral Sinuses — and no doubt there is a considble degree of danger, from the size of these canals,

if

if the Surgeon proceed incautiously. But
We are not to carry this General Rule so
far as to discharge operating here altogether.
For the Surgeon is seldom left to his choice
as when matter, or blood is collected in ye head,
it has made its way to a particular part,
or if a piece of Bone be beat in by a stroke
then We are to ballance between ye danger
of making the Operation & of neglecting it.
If there is the least probability of raising the
bone we ought certainly to do it, observing
the caution of proceeding slowly, and if the
Edges do not make any insuperable
difficulty, for We can cut with one edge of
Circular saw, may it requires experience to
cut a bone of an equal thickness, all thro
at the same time. We proceed then slowly
directing the saw according to the situation
of the Edges, & you are to observe that y^e^
Collateral sinuses are placed nearly upon
the inner side of the Edge that seperates
the smooth part of the bone, from that

part

part which is unperfect by the Muscles.
Nay I apprehend we may make an
Observation more, that certain parts of the
Occipital bone, instead of being properly
shunned are the most fit for some purposes.
Thus when a Suppuration forms upon the
surface of ye brain, it falls down till it is
stopd by the Tentorium, so, avoiding the
middle we may make an opening on
one or both sides of this bone, nay, We
might perform the operation, even under
the Lateral sinus, suspecting the Brain
beat in at the top of the Cerebellum, and
the thinner part of the Muscles, we could
have soon enough to apply ye trephine
lower than the Lateral sinuses, i.e. within
the ridge formd by the Muscles.

Lect. 18th

We next consider the structure of the
Temporal Bones. The Lateral sinuses
after running a good way on ye Occipital
bone

bone, leaves it & goes down upon ye Temporal,
at the root of the Pars Petrosa, and just within
the root of the Mastoid process. Now you will
attend to this circumstance, and that We
ought not, but on the most pressing necessity
to apply the Trepan to the root of the Mastoid
Process. All we can propose by doing so is to
raise a depressed bit of bone, for the sinus coming
in our way we cannot evacuate matter,
Following the sinus further, We perceive it to
go out between the Temporal bone and y^e
occipital. At the back of the Mastoid process in
one subject often perhaps, We find a hole not
it big enough to admit in a probe, and which
makes a communication between the
External & internal Branches. Some from
observing this circumstance have thought
that in Diseases of the Ear We might form
issues at the back of the Mastoid process,
But I do not think that the consequence
will be the same while the sinus veins
be present as at first. We make a drain
near

near to Re part with advantage, but that is not owing to Re size of Re Vein, at least the odds is not so considerable as to merit attention

With regard to Re Surgical Treatment or Application of Re Trepan to Ris bone, it may be broke as in Re rest of Re Cranium not only by a stroke immediately upon it (Tho' Ris will less frequently happen from Re hollowness of it, and from its being covered with Re Temporal muscle & its aponeurosis) but likewise by fissures extending across sutures from Re other parts of Re Cranium. I would only observe that fractures will not so readily extend in Ris manner to Re Temporal bone as to ye others, because Re squamous suture is very seldom obliterated. Still however as We have found that in young subjects Re sutures will not quite prevent Re extent of fracture, y^t it sometimes in fact does, I have seen two instances of it, one of Rem was Re late Mr Lauder Surgeon in town, Re

fell

fell from his horse, & the shock was given on
the Parietal bone, and it extended as far as
the Foramen Magnum occipitis, & a portion
of the Brain was effused on the cloth which
was applied to his head, & yet the Skin was
quite entire, & We only learnd the reason
of this upon Dissection. We found the Fissure
extending thro' the Osa petrosum, & that ye brain
had got out as far as, the Membrane of the
Drum having burst. and I found that y^e
same thing had happend in another case.
But there is a third way in which a fracture
may happen, and which is proper to this
bone, It was just taken notice of by M. Petit
in His Dition of Palfyn's Anatomy. NB.
That when a blow is given to the Parietal
it is not broke, the arch yielding, but ye other
by being push'd outward, may break y^e
weaker scale of the Temporal bone, It is
necessary You know that a bridge should
have abutments, he confined at the sides
He mentions a case of this kind, and I
apprehend

apprehend, after seeing the Operation in Paris, that a case I met with among My Fathers papers has been of this kind, tho' the Person who wrote, or rather delineated it had no such idea —

2. The Temporal bone may be broke in three different ways. Are we then to follow Surgeons who dissuade us altogether from Applying ye Trepan here? I apprehend not, Nay this Rule has been laid down on yt groundless apprehension, that a Wound in the Temple is attended with the utmost danger, on acct of the Tendon which Covers the Temporal Muscle — Now tho' we were to admit that great danger attends wounds of Tendons, yet still greater danger attends wounds of the Brain, from a piece of Bone driven in upon it. But indeed We may use great freedom with Tendons, I have caused operns to be done at different times by cutting the tendon, in one case, two difft. pieces of bone were cut out there, & therefore whenever the

the bone is broke and a portion depressed
Let us follow the extent of the fracture by an
incision, and endeavour to raise it. There is
no ballance between the danger of neglecting
and of performing this operation. We come to
the Sphenoid and after that to consider the
Ethmoid Bone. It is evident that the
Sphenoid Bone can almost never become the
subject of Surgical operations, unless where any
Excrescencies grow out from the lower part
of it, over the Throat, and which are in
danger of extending Pus into & falling in
upon the Medullary substance of the Brain.
But as many of the principle vessels
and Nerves of the body passs thro here
and as it forms principle parts of the Nose
& Eye it merits your particular attention

Lect. 11th

To complete the description of ye Cranium
it only remains that I shew you the
Ethmoid Bone. From what I have
shown

shown of it already, there is little room for any remarks, for except the Os Sphenoides Lamella the whole is concern'd in forming the Nose, and I avoid entering upon the Consideration of the use of this Head, for the same Reasons that I did not speak of the Frontal, and Sphenoidal sinuses, which I am to treat of fully afterwards &c.

Having shown then all the Spaces which compose the Cranium, We shall review the whole, in order to make the situation of the Vessels & Nerves more evident.

I think it unnecessary to repeat all the Cautions that I gave You when We are about to apply the Trepan, We have seen Dangers from the unequal Thickness from Ridges of the bones, from the situation of the Frontal sinuses, as also from the Vessels called sinuses, which convey blood immediately without the bone, and we have taken notice of other Dangers, which arise from age, Constitution

and

and Disease. For the sake of describing ye
Brain in diseased bodies, I think it better
to divide it into three lobes as is usualy done,
than with Dr Walker Boerhaav two only.
calling the two last the Posterior, and I do
really do see a projection before and behind,
and I do find the Anterior lobe divided
from the middle one by a ridge in the
Sphenoid Bone, & between that and the
Temporal bone there is a deep hollow wch
lodges the Middle lobe. 'Tis of but little
Consequence to observe that the Superior
Longitudinal Sinus is determined more
to one side than the other, for the Lateral
Vertebrali being determined to the other
side, in general the Lateral Sinuses are
nearly equal.

Lect. 12th

We next consider the Osseous Part. Here
we find 15 Bones in all, the 13 commonly
described, & 2 lately discovered by Verheyen
and

and Albinus, who have frequently found growing to the Sphenoidal Bone, and as it was found making a part of this bone it was overlooked by former Anatomists.

Some from viewing the situation of the Palate Bone, judged to explain what is here an Paralic, that Diseases the Venereal for instance, after affecting the Palate readily falls upon the orbit, But rather than attribute this to the extent of the Palate bone, we are to look for a Lamen as in the Membranes or in the Bones, for We find that certain membranes and bones, are more readily affected by Diseases than others, some fixing upon the hardest parts of bones, while others affect the softer. With regard to the Os Spongiosa Turbinata inferiora, There is a mistake commonly committed in explaining of the manner of its connection, and a curious part of the structure is overlooked. Albinus indeed in his later tables of the bones, seems to be aware of its true structure,

Maxillare, instead of Nasi being merely tied to
the nose by the Membrane in the young subject
and of growing to it in the adult, We find
that there is a hook by which they hang
upon the edge of the Anterius Maxillare.
In a young subject the Bones is composed
of Two Plates, wch are expanded at some
distance from each other. Swedenborg has
taken it into his head to deny this, but
he is quite mistaken. By use indeed, and
and the pressure of the air, in Respiration
these are drawn together, and at last they
consolidate entirely. As in the Cranium,
so We find here a considble number of bones
by which means the Ossification begenns
at a number of points at once, is soonest
completed, & this irregular shape formed.
and this was the more necessary here
as the bones want a mould on which to
shape, for guiding the progress of their
fibres such as the Cranium finds in yc
brain. The situation of the Bones here, and

do

to mention the purposes wch the Sinuses
serve with respect to the Voice, protects the
orbits, and by the greater extent, gives room
for the insertion of the Muscles, wch
are very numerous, but the same time
allows the Motion of those We found too
that the Circumference of the face, is formed
of very hard bone, while the Cheeks & Chin
bones are only found towards the inner
part, where they are sufficiently protected agt
common accidents. If we look into the
Orbit & consider its shape, we may remark
a circumstance of wch generally understand
the application afterwards, that the outer
side of it is placed very slanting, whereby
inner appears a great deal straighter, and is
at the same time deeper, by which means
the Sphere of Vision is increased. We further
observe that the inner side of both orbits
are large & to almost parallel to each
other, & we should find that the part

at

at which the optic nerve enters is insensible to objects, but as the two eyes can never be directed to the very same point, a person who has the use of both never loses any object.

We also find that the foramina optica are at the inner side of the ball, for this purpose the nerve enters near to the nose, so that we are not able to see at once both these holes, & therefore no object can fall on both at the same instant.

Lect. 13th

We next attend to the parts of the Lower Jaw. We attend partly to the place of its connection, and to its motion, for it has been supposed that the condyle occupies more of the hollow of the temporal bone than it really does, it being only lodged on the fore edge of the hollow, and the capsular ligament including but the half of the hollow, with the whole of the root of the zygomatic process, and we see between the hollow and the

Tooth

Root of the process, and the Condyle has an
Articular cartilage which divides ye Capsular
ligament into two pacts, One enclosing the
Zygomatic process, & Another the Condyle.
Now, in what manner does the jaw move?
Many have supposed that it moves in
the Hollow, & that the Condyle of its centre
of motion, But instead of that, when We
open our mouth, the Condyle of the jaw
comes forward upon the Root of ye Zygom^a
process & downward at the same time.
and I suppose that I mean to turn the jaw
to aside, suppose to the right, I allow the
left Condyle to remain on the Root of the
Zygomatic process, and pushs back the
Right into the Hollow, and in shewing
We perform this very complex kind of
motion. It is of real consequence to
attend to the motion I have now described
& to observe that the axis of the Motion
is not in the Condyle, but lower than it
Thus suppose a wire to be passed thro'

the

the neck of the Condyloid process, & the Jaw to be
moved on that axis, the Condyle moves upon
this part of the Jaw as its centre.

Now the application of this is w.th respect
to the luxation of the Jaw which I have seen
several times. it is evident that this happens
most readily when with the Mouth open
a Person receives a blow, or when a very
unguarded motion, yawning, the opening
the Mouth very wide is made Now we
explain this very readily. The Jaw is
then in a most dangerous situation,
standing on the top of a convex substance,
and if suppose a shock given to the chin
the Condyles readily slip forwards. Another
fact observed by Surgeons is, that when
we attempt to reduce luxations of the jaw,
we are not merely to push the Condyles
back, but we must first push the Jaw
down, & bring it downwards a little forwards.
The common opinion & reason for that

is

is, that the Coronoid process catches the cheek bone, and this appears probable in some degree when we look only at the Skeleton, but from the Attachment of the Temporal muscle, the Coronoid process cant pass in that manner over the cheek bone, may I find that I can put the point of my finger between that and the back of the Condyle catches the fore part of the Zygomatic process. So in order to disengage it we must draw the Jaw forwards a little, & downwards before we attempt to push it backwards. and even in Healthy Persons in order to do this & to draw the bone, it becomes necessary that the Surgeon should employ his whole strength upon that side, and the one Condyle follows the other.

After shewing the Structure of the Jaws, following the order of the text, I should enter upon the Structure of the Teeth, But I am at present only to mention a few of the most

most obvious circumstances with regard to them, as the same objection lyes against the full consideration of them here, as against treating of the bones in general. That it leads to very remote enquiries — I next proceed then to explain a very necessary part of Anatomy Viz. The structure of the Bones & Cartilages which we feel in the throat. The Os Hyoides and the Cartilages serve to suspend the Larynx, which rests as it were upon them. Next, You may consider them as Divers to which the parts of the throat are regulated. Then we find that as the Larynx makes the fore part of the Pharynx, its back part rests the head to the Vertebræ, so that if the Larynx is drawn forwards when we are about to swallow, the Pharynx is dilated & opened for the reception of the food, and in order to push it down, we pull the Larynx back, which affects it muscular fibres, and the contraction being determined downwards the food is thrown with force into the Oesophagus. The Cartilages of the

Larynx

Larynx serve also to prevent the air from being intercepted from the Nose Downwards it falls perpendicularly down thro' ye larynx, while the epiglottis hinders food or drink from falling into it which is more than sufficient to cover it, tho' you will find the contrary asserted in Boerhaaves Institutions. I shall afterwards also shew you, that the Voice is formed in the Larynx. There are two cords or ligaments extended between the Thyroid Cartilages & the Arytenoid which make a triangular opening the Basis of which I can shut at pleasure, by bringing together ye Arytenoid Cartilages. These Cartilages then can be so influenced as to give different degrees of tensions to these ligaments, & it is in this way that we form the Voice, & increase the strength of it at pleasure. If these ligaments are relaxed, & at the same time separated we have a low flatt sound, if again they are stretched & brought near together We have an acute sound, and so by varying the tension of the ligaments, & the size

of

of the spring, we have all ye advantages of the several wind & string'd Instruments.

Lect. 11th

Having now finish'd the Anatomy of the Head & Throat, which is immediately connected with it, We proceed to examine the Structure of the Trunk. and 1st of the Spine, & instead of making the Remarks wch ye Demonstration I shall confine myself entirely to it, wch method tho' less entertaining, will be more distinct here, as My Observations will be understood much better, after the several pieces & their motions have been fully considered.

Lect. 15th

Now that We have seen all ye material parts of the Structure, I shall endeavour to explain the use of each part, and to draw such consequences as may seem useful from it. We consider the Spine as serving 1st as the pillar which supports the Head, & the Trunk of the body, 2dly It lodges & protects ye spermatic Nerve, the Spinal Marrow, conducts it safely to the place of its destination, and lastly from its number of joints, it serves to give all the

The Variety of motions to the Trunk of ye body.
To yt it for making a firm base we have
found the bodies of the Vertebræ of considerable
breadth; but to add a greater extent to the basis
We find that the Vertebræ likewise touch behind,
or are connected by the Oblique Processes. The breadth
of the bodies, whilst it serves to extend ye basis,
likewise gives opportunity for a firmer connection,
gives more room for the Intervertebral connecting
Medium the Cartilage, This connection is surer,
and the bodies are protected by other bones,
by the Muscles, by the Bowels. We find Nature
every where endeavouring to ease us of the
unnecessary load of bone, thus framed there of
a spongy texture, excepting only the thin plate
at the Circumference, & the Epiphyses upon that
which are more immediately exposed to pressure.
But behind We find the Processes made of a
very hard bone, as they are much more
exposed to injury, & want the soft Cartilage
substance between them, being only tyed
wth Cartilage & tied by ligaments, so as they
sustain a greater shock, There is a necessity
for their substance being more resisting.
In the posterior part we find the long
processes, the Spinal & Transverse, We consider
them

them as making just & proper Defence to ye
Spinal Marrow, but more especially ye Spinal
processes, which are in ye head placed in a Strait
Direction, so that a pointed instrument is prevented
from entering between them. Hence much more
Danger attends wounds of ye Neck, than of ye
Back or Loyns, particularly about ye top
of ye Neck, where a considerable space is left
between ye processes, wch are almost perpendr.
to it is ye custom in some Countries, to kill
Cattle by pushing a pointed Instrument
between ye first & second Vertebra. But besides
you are to view them as giving not only a
greater room or Surface for ye connection of ye
necessary Muscles, but as altering ye Direction,
and which is of still further moment, ye
Muscles are enabled to act much more powerfully
on ye Trunk, acting with a Lever of very
considerable strength. From what you have
seen of ye Intervertebral Cartilages indeed you
would be at a loss to point out ye Centre
of Motion, but by shaving off ye Bones of
another Animal, it is evident that ye motion
is performed upon a very centre of ye body
of ye Vertebra, for there instead of a Cartilage

there

There is a ball & Socket, with a Capsr Ligament,
We find this Mechanism in the Vertebræ of
some fish, as in the Whale, where there is too
an Intervertebral soft substance. My Father
in the N.D. Essays has described a curious
Mechanism, that this motion is performed
in a Ball, in the very middle of an inter-
vertebral substance, but in the middle part instead
of being much harder, he found a round
bag filled with Mucous, or a fluid having
little compressibility which serves as a fulcrum
on which the whole turns, and by e motion
is made in that way with a less shock
than on a more solid body. And viewing
now the structure of y e human Last Bone
We find that the Disc of the Intervertebral
substance is harder, so that the middle or
Mucous part, serves nearly the same purpose
as in the Whale. There is still another
use of this Intervert. substance which is
scarcely attended to by Authors, viz. When
We are to make a motion of the body
forwards &c as the Spinal marrow is loosely
lodged behind the Centre or axeis of the motion, if
You were to suppose the bones merely lifted
with

with Cartilage, or nothing placed between, it will yield considerably, the Spinal marrow, in making such a flexion, would have been drawn out to a much greater length than when the Column is placed Perpendicularly, but by the interposition of a substance like Cork, which yields in that manner, when the weight is thrown forward & this substance is compressed so the whole column made shorter, & the lengthening of the Spinal Marrow prevented.

With the like view we find the motion divided among a vast number of Joints, so that each yielding a little, a sufficient flexion can be performed, while no part of the Spine is strained in a violent degree, In some Animals as the Frog where the Spinal marrow is shorter a greater flexion is made by a few Joints, but it is thrown under the place that lodges the Spinal Marrow, after it is divided into a great many Assistant Branches.

When we view the whole column connected together, we readily explain the shape, that it is Cylindrical, and the breadth of the Base is continually increasing, We thereby stand with

with greater Facility, or if We were to construct a pillar of stone we would give it a shape nearly Resembling this. We can see a further Reason for this When We make a motion the weight of the part acts with more advantage on the Root than on the top of the Spine, Suppose the head alone was supported by it, upon making a flexion we would be more in danger of drawing asunder the lowermost parts, and the Weight is continually increasing, so a greater breadth is necessary to give room for a greater number of Cartilaginous & ligamentous fibres. In fact We possess with every Joint of Vertebræ the flexion and Extension in every direction, for these Cartilages yield in all directions. I can even bend the Dorsal Vertebræ sideways though not so much as those of the neck & loins. And the Cartilage has an excellent effect upon making a sudden motion it lessens the shock, hinders the body from descending too quickly, & assists in raising it again. We further possess with every joint of the spine the power of twisting the body, but this we do most readily at the top of the neck.

To see then of the structure and of the

The motions that are performed, We are next to attend to some facts that account for certain Diseases to which the Spine is more immediately exposed. You have seen that ye whole weight of our bodies is supported on an elastic, compressible substance, which I have compared to Cork, & the Thickness of that, supposing all ye Cartilages found together is very considerable, making perhaps 1/4 or 1/5 part of ye whole length of ye Spine. It must readily occur to You therefore, that in the erect posture, we are continually losing of our height, that We are taller in ye Morning than in the evening. This is so very evident that You would suppose the thing must have been ascertained long ago by experiment. It was only discovered however lately accidentally by a Gentlemen in England. In fact We lose from 1/4 of an inch, more or less according to the Size constitution and length of the Person. Tall young People lose near an inch, but in general the loss is near 1/4 or 3/8 of an inch. The whole loss is in the Cartilage, not in the bones, Not in the processes for the person loses as much sitting as standing. A horse loses nothing,

from

from the Horizontal situation of this Spine.
Perhaps every Cartilage may lose a somewhat
in the common joints, but the loss is so very
inconsiderable that we do not observe it.

Now from this we understand the reason
of what we frequently observe that old People
bend forwards naturally. This change is that
the Cartilages grow gradually thinner, they are
more compressed & yield more than the
processes behind, so that the Body at length
becomes to be Bent forwards. This teaches us
this further, for if Bending be a Natural
change and that a Person in a single day
loses considerably of his Stature, Whenever from
any disease or accident the Body is drawn off
its proper Basis, or ballance, one part of the
Spine comes to be compressed, and the Cartilages
grow much thinner on that side, whilst
the other side has its fibres drawn out. And
if the Body be long kept in this situation
it acquires an unequal Growth, & thence
Curvitures are very readily gained. And
we often see Curvitures of the Spine from
every Spot where there was no such
disease as is said to produce a curvature;

in

in the Humours, and to occasion swelling and Inflam^{n} in consequence of that. So independent of the changes made by ye Lues Venerea Scrophula, Rickets &c The Spine may be crooked from any cause which keeps the body too long leaning over to one side. In like manner if our body is seized with a Spasm or Palsy on one side, or if from any misfortune One of the legs is shorter than the other, and no means taken to support the body equally, the same effect may be produced, Or a Person may hurt on the complaint by a Person habitually sitting. So far I apprehend is quite evident, but let us pursue this, You see here a crooked a Spine, when the shape of the several pieces is altered, and you observe that the curvature is in more directions than one, & that there is more than one curvature, I suppose that habit or any other circumstance induced this Person to bend any boy's right side, the curvature encreases for beyond this intention, the body falls over more, and a Luxurians growth takes place on the other side, This body then is very much

Thrown

throwen off the common Basis, & endeavours
to cure by this by an endeavour of Nature, to
throw the Centre of Gravity between the legs.
Hence you almost never see a single Curvature,
there are always two & sometimes a greater
number. but still the general weight falls
upon the os Sacrum, In some cases the
ligaments of the Vertebræ at length almost
obliterated, so that one Vertebra comes to
touch the 4th or 5th below it producing from
that the side. And this is the plain reason
why People who are crooked in ye Spine
commonly much more in stature by age
than others. A Person who is remarkable
for being little when Young is much more
so when Old, the Curvature continuing generally.

Now in such cases What kind of Prognosis
as well of Cure is to be attempted?

If the Person is afflicted with any known
indisposition of the Viscera, as w^t Gout,
Scrophula, Rickets &c We begin with the
proper method of curing those Diseases,
and those being subdued & eradicated We

attempt

attempt by Machinery to Counteract ye Curvature,
But with what prospect of success is this to be done?
If you look into our Book Book, you will find
Two or Three examples where the Curvature
was Counteracted by very simple directions
at the beginning — My Father used to mention
the case of a Boy, who had one side crooked by
leaning too much over the back of a Chair, at
the Side of the Fire, after a tedious illness. The Cure
there was obvious all that was necessary was
just to place the Chair on the opposite side
of the Fire. In a 2^d Case a Girl had contracted
a Curvature by being in the habit of sewing
at a stent in Doors which one hand was
constantly kept above & the other beneath,
and this was Counteracted by the Girls
endeavouring to sew with y^e other hand, &
so placing the body in the opposite situation.
In a 3^d Case the habit was contracted by
sewing in the ordinary way. But Not=
=withstanding the encouragement from
such cases, the prospect of success,
when the Curvature is perfectly Recent,

is

Spine is continued any length of time, and is made sideways, (for instance in a habit or sea complaint, is obliged to lean long forwards or backwards, I would have more hopes of such a cure as we see a Wry Carriage in Girls is every day cured by wearing a Collar) and more especially if that continued long, so long that the first curvature is counteracted by the formation of a second we should be cautious in forming a Prognosis, as it is impossible to apply Machinery to counteract it with any degree of exactness.

Next, We consider the changes that may be made in the Luxation of the Spine. From the very close connection and adhesion of the two pieces to each other it is evident that excepting only the uppermost pieces they cannot be separated unless by very great force. And therefore we can scarcely suppose a total & complete separation to take place without material danger being done to the Spinal Marrow, for it is scarcely possible that a complete Luxation can take place without such an affection of

of the Spinal marrow, as must prove fatal
Many from the Lessens of the connection you
will find not many instances of Luxation
of the Spine in Authors. A learned German
Writer has been at a good deal of pains upon
this subject, and he has only been able to
collect two or three such instances. I have seen
one instance of a compleat Luxation in the
Neck which proved fatal, Whereupon examining
the body very carefully, I was not able to
distinguish certainly a Lesion in the Spinal
marrow. Therefore, tho' the common effect
will be a Laceration of its fibres, we cannot
to take this without exception (See Medical
Commentaries Vol. 1 p 216) In such a Case
We endeavour in the common way to
stretch the Parts, and to keep them in their
proper situation by means of a piece of
Pasteboard, with Tin Wales, and in that
way give the Patient all the chance he
can possibly have. But tho' We can
scarce imagine a compleat Dislocation of the
Spine that is curable, yet We may conceive
a

a Dislocation of the Oblique processes of which the one may readily slip off from the other, & be entangled by it. Suppose that a Person leans forwards, and that in this posture he receives a violent blow, wh. increases the flexion in this case as in other Luxations, ye Ligaments may be lacerated, and the edge of the one process may be also lacerated on ye other, so that the Person attempting to raise himself finds it impossible, nor can the parts be replaced even with assistance. Now how are we to perform a Cure in such Cases? Some have directed the Patient to be laid on his belly, & a great bar of iron laid across the back, and the pieces to be thrust in by force, but in this way we do not disengage the pieces, we only break the bones, and may wound the Spinal Marrow; We are therefore rather to follow Hippocrates, Petit &c who propose to separate the pieces first by increasing the Flexion, by bending ye Body more, as by laying it across any Round substance, and then to raise

the

the Patients body exerts the Surgeon endeavouring with his hand to push the Bone back into its proper place

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